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MUNICIPAL, INDUSTRIAL AND DOMESTIC WATER SUPPLIES, POLLUTION ABATEMENT, PUBLIC HEALTH. OGEECHEE BASIN

Public Health Service
Atlanta, Georgia

October 1961

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UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service, Region IV
Water Supply and Pollution Control Program

Technical Memoranda

for

Municipal, Industrial and Domestic Water Supplies
Pollution Abatement
Public Health

OGEECHEE BASIN

Prepared for

United States Study Commission,
Southeast River Basins
Atlanta, Georgia
Revised October 1961

TABLE OF CONTENTS

Page

LIST OF TABLES vii

LIST OF FIGURES ix

INTRODUCTION

PREFACE I-1

Authority I-1

Economic Basis for Planning I-2

RESPONSIBILITIES I-2

Public Health Service, Department of Health, Education, and Welfare I-2

Corps of Engineers, Department of Army I-3

Soil Conservation Service, Department of Agriculture I-3

Forest Service, Department of Agriculture I-3

Geological Survey, Department of Interior I-4

National Park Service, Department of Interior I-4

Atomic Energy Commission I-4

Georgia Department of Public Health I-4

Georgia Water Quality Council I-6

Georgia Resources Commission I-6

Georgia Department of Mines, Mining, and Geology I-6

Local Health Departments (Georgia) I-7

Georgia Oil and Gas Commission I-7

Georgia Game and Fish Commission I-7

Water Purveyors I-7

Page

DESCRIPTION OF THE BASIN I-8

General I-8

Climate and Hydrology I-9

Geology I-9

Population I-10

Resources I-10

MUNICIPAL, INDUSTRIAL AND
DOMESTIC WATER SUPPLIES

INTRODUCTION W-1

Scope of Memorandum W-1

Procedures and Investigations W-1

Basic Assumptions W-2

QUANTITY AND QUALITY OF WATER AVAILABLE FOR WATER SUPPLIES W-3

Surface Water W-3

Ground Water W-4

MUNICIPAL WATER SUPPLIES W-4

Inventory W-4

Present Status of Water Supply Systems W-6

Water Supply System Requirements for 1960 ..... W-6

Projections W-7

Future Water Supply System Requirements W-10

Present Water Rate Structure W-10

Annual Costs W-10

Benefits W-12

	Page
DOMESTIC WATER SUPPLIES	W-12
Inventory	W-12
Present Status of Water Supply Development	W-12
Water Supply System Requirements for 1960	W-13
Future Water Supply Requirements	W-13
Annual Costs	W-15
INDUSTRIAL WATER SUPPLIES	W-15
Inventory	W-15
Present Status of Water Supply Development	W-15
Quality	W-17
Future Water Supply Requirements for 1975 and 2000	W-17
Annual Costs	W-18
Benefits	W-18
SUMMARY AND CONCLUSIONS	W-19
Summary	W-19
Conclusions	W-20

POLLUTION ABATEMENT

INTRODUCTION	P-1
Scope of Memorandum	P-1
Procedures and Investigations	P-1
Basic Assumptions	P-1
General	P-3
INVENTORY OF POLLUTION ABATEMENT	P-4
Sources of Pollution	P-4
Existing Sewage Treatment Facilities	P-4

	Page
INVENTORY OF POLLUTION ABATEMENT (Cont'd)	
Effects on Streams	P-7
POLLUTION ABATEMENT REQUIREMENTS FOR 1960	P-10
Sewerage	P-10
Treatment Facilities	P-10
Other Needs	P-12
FUTURE POLLUTION ABATEMENT REQUIREMENTS	P-12
Projections	P-12
Sewerage	P-15
Treatment Facilities	P-15
LOW FLOW AUGMENTATION	P-17
General	P-17
Areas Where Augmentation Is Not Needed	P-19
Areas Where Augmentation Is Needed	P-19
ANNUAL COSTS AND BENEFITS	P-21
Financing	P-21
Operating Revenues	P-21
Annual Costs For 1960	P-22
Annual Costs By 1975	P-22
Annual Costs By 2000	P-22
Benefits	P-23
SUMMARY AND CONCLUSIONS	P-24
Summary	P-24
Conclusions	P-25

Page

PUBLIC HEALTH

INTRODUCTION PH-1

VECTOR CONTROL PH-2

Introduction PH-2

Existing Vector Problems PH-2

Status of Existing Programs PH-6

Existing Needs PH-8

Potential Problems and Solutions PH-10

Costs and Benefits PH-11

AIR POLLUTION PH-14

Problems PH-14

Status of Existing Programs PH-14

Existing Needs PH-15

Potential Problems and Solutions PH-15

Costs and Benefits PH-15

RADIOLOGICAL HEALTH PH-16

Problems PH-16

Status of Existing Programs PH-16

Existing Needs PH-17

Potential Problems and Solutions PH-17

Costs and Benefits PH-17

SOLID WASTES PH-18

Introduction PH-18

Problems PH-18

Status of Existing Programs PH-18

Page

SOLID WASTES (Cont'd)

Existing Needs PH-19

Potential Problems and Solutions PH-19

Costs and Benefits PH-19

SUMMARY AND CONCLUSIONS PH-21

Summary PH-21

Conclusions PH-22

APPENDICES AND BIBLIOGRAPHY

APPENDIX A

BIBLIOGRAPHY

LIST OF TABLES

MUNICIPAL, INDUSTRIAL AND DOMESTIC WATER SUPPLIES

Table		Page
W-1	Basic Data on Municipal Water Supply Systems	W-5
W-2	Municipal Water Supply Systems Estimated Needs and Costs for 1960	W-7
W-3	Municipal Water Supply Systems Projected Needs and Costs for 1975	W-8
W-4	Municipal Water Supply Systems Projected Needs and Costs for 2000	W-9
W-5	Basic Data on Domestic Water Supply Systems	W-14
W-6	Basic Data on Industrial Water Supply Systems	W-16
W-7	Projected Industrial Water Requirements for 1975 and 2000	W-17

POLLUTION ABATEMENT

P-1	Basic Data on Sources of Municipal Pollution	P-5
P-2	Basic Data on Sources of Industrial Pollution	P-6
P-3	Municipal Pollution Abatement Estimated Needs and Costs for 1960	P-11
P-4	Industrial Pollution Abatement Estimated Needs and Costs for 1960	P-12
P-5	Municipal Sewage - 1975 and 2000	P-13
P-6	Industrial Pollution - 1975 and 2000	P-14
P-7	Estimated Costs of Municipal Pollution Abatement - 1975 and 2000	P-16
P-8	Estimated Costs of Industrial Abatement - 1975 and 2000	P-17
P-9	Minimum Flow Requirements	P-18
P-10	Reservoir Storage Needs	P-20

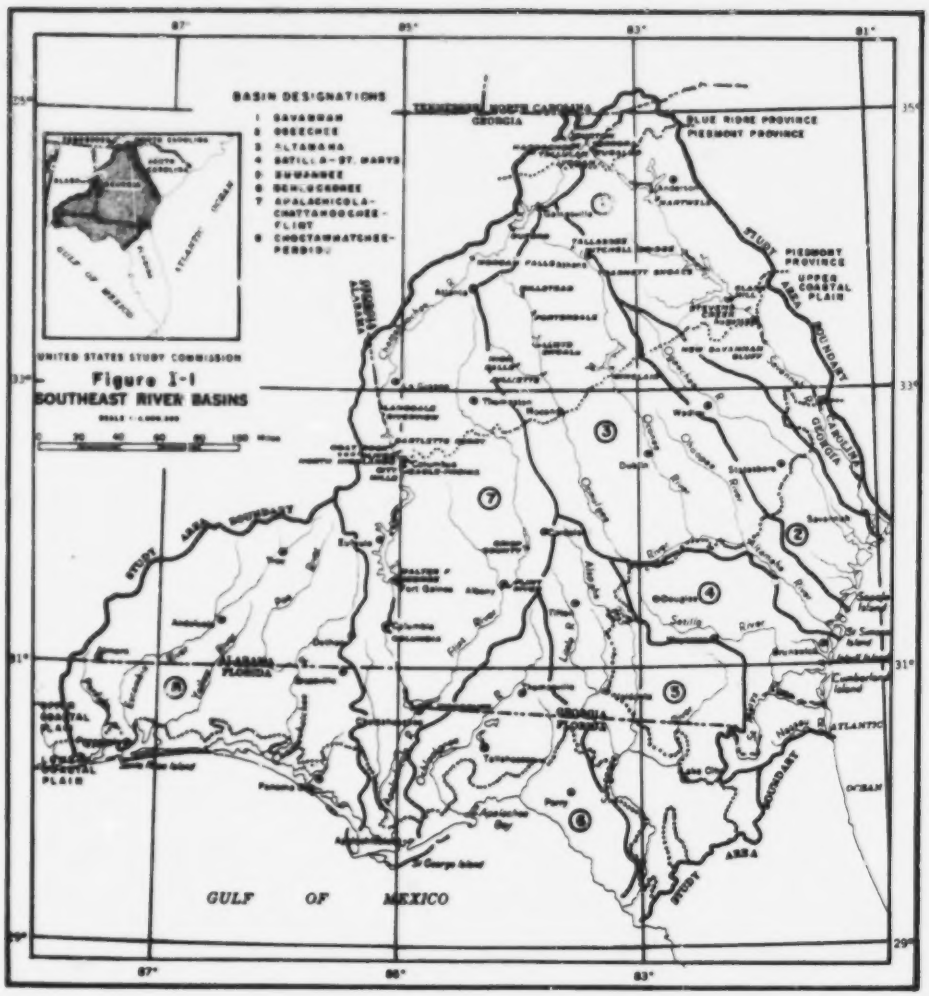
(10/2/61)

PUBLIC HEALTH

Table		Page
PH-1	Vector Problems and Programs	PH-12
PH-2	Land Requirements for Refuse Disposal Years, 1960 - 2000	PH-19

LIST OF FIGURES

Figure		Page
I-1	Southeast River Basins	I-i
W-1	Municipal and Industrial Water Supplies	W-i
P-1	Sources of Pollution	P-i


BASIN DESIGNATIONS
1 SAVANNAH
2 OGEECHEE
3 ALTAMAHA
4 SATILLA-ST. MARYS
5 SUWANNEE
6 OCHLOCKONEE
7 APALACHICOLA-CHATTAHOOCHEE-FLINT
8 CHOCTAWHATCHEE-PERDIDO
UNITED STATES STUDY COMMISSION
Figure I-1
SOUTHEAST RIVER BASINS
BLUE RIDGE PROVINCE
PIEDMONT PROVINCE
UPPER COASTAL PLAIN
LOWER COASTAL PLAIN
GULF OF MEXICO
ATLANTIC OCEAN

(10/2/61)

PREFACE

AUTHORITY

This work by the Public Health Service was initiated at the written requests of the U. S. Study Commission, Southeast River Basins. These were dated December 30, 1959 and March 11, 1960.

The Study Commission's requests are in partial fulfillment of its obligation under Public Law 85-850 which states in part "In carrying out the purpose of this Act it shall be the policy of Congress to utilize the services, studies, surveys and continuing investigational programs of the departments, bureaus, and agencies of the United States." The Act also states that the Commission may "secure directly from any executive department, bureau, agency, commission, office, independent establishment, or instrumentality, information, suggestions, estimates, and statistics for the purpose of the Act, and each such department, bureau, agency, board, commission, office, establishment, or instrumentality is authorized to furnish such information, suggestions, estimates and statistics directly to the Commission, upon request by the Chairman or Vice Chairman."

The authority for the Public Health Service to undertake this study and the preparation and submission of these technical memoranda stems from the above and from the Public Health Service Act of 1944 (Public Law 410, 78th Congress), and its amendments; the Federal Water Pollution Control Act (Public Law 660, 84th Congress), and its amendments; the Federal legislation on air pollution (Public Law 159, 84th Congress), with amendments; related miscellaneous provisions of other statutes; and the Public Health Service Regulations.

Public Law 85-850 provides for investigations and studies and the preparation of a comprehensive and coordinated plan for the conservation, utilization, and development of land and water resources in the study area. In this plan formulation the law specified, among others, the inclusion of plans for:

1. domestic and municipal water supplies;
2. possibilities of industrial development and utilization;
3. pollution abatement and the protection of public health; and
4. such other beneficial and useful purposes.

This report covers these areas in three technical memoranda. A separate paper will contain basic data on water quality for the entire Southeast River Basins area. Public health aspects, in the one memorandum on this subject, include vectors, air pollutants, solid wastes and radiological pollutants.

(10/2/61)

ECONOMIC BASIS FOR PLANNING

Projections for 1975 and 2000 in this report were made using estimates of economic development furnished to the Public Health Service by the U. S. Study Commission, Southeast River Basins. The pattern of the future economy stems mainly from projections of population, employment, and income furnished by the Commission. The basic aggregate projections for these three components are considered by the Commission to be relatively firm. In addition, the breakdown of the basic projections into their different components and the derivation of data for river basins is based on limited information. The Commission emphasizes that these are preliminary estimates and that the pattern of the projected economy should not be taken as rigid goals, but should be considered flexible and subject to modification and refinement as the results of future studies become available. The projections contained in the several sections following are, therefore, subject to revision and change as further information and economic projections become available.

RESPONSIBILITIES

PUBLIC HEALTH SERVICE, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

The Public Health Service serves in a consulting capacity to other Federal agencies and to State and local health departments on matters relating to water supply, water pollution control, vector control, and other matters related to public health; makes investigations and studies; does scientific research in the above fields; collects vital statistics; and operates certain medical care and quarantine programs. In protecting the public health, the Service is responsible for developing and recommending procedures for the prevention and control of mosquitoes and other vectors associated with Federal water development projects.

As part of its responsibilities under the Federal Water Pollution Control Act (Public Law 660, 84th Congress) and its amendments, the Service is required to prepare or adopt (in cooperation with other Federal agencies, State and interstate water pollution control agencies, municipalities and industries) comprehensive programs for eliminating or reducing the pollution of navigable waters and tributaries thereof and improving the sanitary condition of surface and underground waters. In the development of such comprehensive programs, due regard must be given to the improvements which are necessary to conserve such waters for public water supplies; propagation of fish, aquatic life, and wildlife; recreational purposes; and agricultural, industrial and other uses.

The Public Health Service is authorized to make joint investigations, with other governmental agencies, of the condition of navigable waters in any State or States, and of the discharges of any

sewage, industrial wastes, or substance which may adversely affect such waters. Section 8(a) of Public Law 660 states that "The pollution of interstate or navigable waters in or adjacent to any State or States (whether the matter causing or contributing to such pollution is discharged directly into such waters or reaches such waters after discharge into a tributary of such waters), which endangers the health or welfare of any persons, shall be subject to abatement as provided in this Act."

The Public Health Service works closely with State agencies and makes investigations and studies relating to health and pollution control aspects of development programs pertaining to municipal, industrial, and domestic water supplies.

The Service also has the responsibility of collecting and disseminating basic data on radiological, chemical, physical, and biological water quality and other information insofar as such data and information relate to water pollution and the prevention and control thereof. The Service cooperates with agencies listed below in health matters pertaining to that agency's operation.

CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY

The Corps of Engineers operates the Federal program for the improvement and maintenance of rivers and other waterways in the interest of navigation and flood control. Water conservation and other water use functions beneficial to the public are considered in carrying out investigations and construction of water projects. Health matters relating to these projects include insect control, sanitation of work camps, recreation, water supplies, and water pollution abatement.

SOIL CONSERVATION SERVICE, DEPARTMENT OF AGRICULTURE

The Soil Conservation Service, under Public Law 566, 83rd Congress, prepares watershed work plans for small watersheds to assure water-flow retardation and soil erosion prevention. In the development of these work plans, consideration is given to water use functions beneficial to the people of the area, including irrigation, stock watering, and fish and wildlife protection. Control of insects around the watershed and use of water for domestic purposes are also given consideration. These plans are reviewed by the concerned agencies in the States.

FOREST SERVICE, DEPARTMENT OF AGRICULTURE

The Forest Service is responsible for the development and management of National Forests to preserve and increase the multiple benefits from these natural resources. Good forest management retards rapid runoff and prevents soil erosion, thus reducing

pollution from natural sources. Sanitation of public facilities in National Forests is under the supervision of the Service and privately operated facilities are regulated by use permits issued by the Service. It is to be noted, however, that Section 480, Title 16, U. S. Code states that jurisdiction over persons within National Forests should not be affected by the reason of these forests' existence. Thus, health and sanitation in National Forests are also of concern to State and local health authorities.

GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

The Geological Survey is primarily a fact finding and research agency. It collects, analyzes, and interprets basic data on water, mineral, and land resources, and prepares topographic and geological maps and reports as a prerequisite for planning, constructing and operating projects for the development and utilization of these natural resources.

NATIONAL PARK SERVICE, DEPARTMENT OF THE INTERIOR

The National Park Service administers programs for National Parks, monuments, historic sites, and similar areas. It has the responsibility for maintaining sanitary and healthful conditions in these areas. The Service cooperates with other agencies in investigating the recreational possibilities at proposed reservoir projects and in planning for their protection, development, and utilization.

ATOMIC ENERGY COMMISSION

To protect against hazards to life or property, the Atomic Energy Act of 1954 authorizes the Atomic Energy Commission to regulate the use of certain radioactive materials and certain facilities which produce or use these materials. A National Committee on Radiation Protection, comprised of a member from the Public Health Service plus other Federal agencies and professional organizations, prepares recommendations on protection from radioactive substances.

GEORGIA DEPARTMENT OF PUBLIC HEALTH

The State has retained all responsibilities and duties for the health of the public not otherwise granted to the Federal Government in the Federal Constitution or by Acts of Congress. The State operates under the police power, inherent in the sovereign State to enact and enforce laws to protect and promote the health, safety, morals, order, peace, comfort, and general welfare of the people.

Among the powers of the State Board of Health are the following:

1. Adopt rules, regulations, and orders.

2. Enforce State laws, regulations, and orders.

3. Isolate and quarantine, make sanitary investigations and inspections, and collect vital statistics.

4. Review plans and specifications for any new municipal water systems to be installed, or changes to be made in any existing system by any city, corporation, partnership, or individual.

5. Inspect the source of municipal water supply, and to determine if the water is impure and dangerous to individuals or to the public generally.

6. Act in a consultative capacity to local agencies.

7. Approve and regulate the impounding of waters as they affect vector control.

The Georgia Water Quality Act (Laws of Georgia, 1957, Act No. 491) provides for the control of water quality within the State and the regulation of public water supply treatment facilities. It prohibits the discharge of sewage, industrial wastes, or other wastes into the waters of the State which would adversely affect the health of the people or render such waters unsuitable for their then current uses, and provides for the treatment of such wastes. It provides for the issuance of certificates to persons discharging or permitting to be discharged into the waters of the State any sewage, industrial wastes, or other wastes.

The Act declares it to be the policy of the State of Georgia that the water resources of the State shall be utilized prudently to the maximum benefit of the people without so impairing the quality of the water resources as to jeopardize public water supplies and public health, and without interfering unreasonably with beneficial use of the water resources for recreation, fish and wildlife development, agriculture, and the industrial development of the State's natural resources and manpower. The State water pollution control agency (State Board of Health) is charged with the responsibility, and has the authority to require the use of reasonable methods to prevent and control the pollution of the waters of the State.

(10/2/61)

The State Board of Health under the Water Quality Act has the responsibility and power to establish, as it deems necessary, such standards of quality for any waters in relation to the reasonable and proper use thereof, and such general policies and standards relating to any existing or future pollution of such waters. The State Board of Health has the power to issue orders directing any particular person or persons to secure within the time specified therein, such operating results as are reasonable and practicable of attainment toward the control, abatement, and prevention of pollution of the waters of the State and the preservation of the necessary quality for the reasonable use thereof.

The State Board of Health has the power to establish such policies, requirements, and/or standards governing the source, distribution, purification, treatment and storage of water for public or community water supply systems as it deems necessary for the reasonable and proper use thereof in conformity with the intent of the Water Quality Act. The Act states that it shall be unlawful for any person to erect, construct, enlarge, extend, open, reopen, or operate any public or community water supply system, including storage, distribution, purification treatment facilities or works, without having first secured from the Board approval of: the source of water supply; the means and methods of treating, purifying and storing water; plans and specifications for the construction of facilities or works; and the operation thereof.

GEORGIA WATER QUALITY COUNCIL

This council makes recommendations to the State Board of Health with regard to regulations, procedures, standards, waste disposal certificates, and policies governing public and community water supplies and waste disposal into waters of the State for controlling pollution and quality of such waters.

GEORGIA RESOURCES COMMISSION

The Commission is responsible for inventorying the State's water resources and gathering such data as are necessary for determining what further legislation is needed with regard to quantitative control of the State's water resources. A state water engineer, appointed by the Commission, is authorized to employ a water resources fact finding and research staff to be known as the Georgia State Water Survey.

GEORGIA DEPARTMENT OF MINES, MINING, AND GEOLOGY

The Division of Conservation in this Department collects and compiles water resources data and cooperates with the United States Geological Survey, United States Soil Conservation Service, and State Soil Conservation Committee on surface and ground water surveys and chemical quality of waters; and cooperates with the State Highway Department on flood control.

(10/2/61)

LOCAL HEALTH DEPARTMENTS (GEORGIA)

Georgia laws provide for the formation of county boards of health. These are created for the purpose of carrying out State rules, regulations, and orders as well as adopting other regulatory measures needed for protecting the public health within the local jurisdiction. Local Boards of Health in Georgia have the power to:

1. Adopt rules, regulations, and orders.
2. Enforce State laws, regulations, and orders.
3. Enforce local regulations and ordinances.
4. Make sanitary inspections and investigations, to isolate, quarantine, and to abate nuisances.

GEORGIA OIL AND GAS COMMISSION

The Georgia Oil and Gas Commission is authorized to make rules, regulations and orders for the prevention of the pollution of fresh water supplies by oil, gas or salt water (1955 Cumulative Supplement, Title 43, Section 713).

GEORGIA GAME AND FISH COMMISSION

In the protection of fish and other aquatic life, the Georgia Game and Fish Commission is vitally interested in habitat waters. This agency cooperates with other State and Federal agencies in investigations and studies of water quality as related to fish and other aquatic life. The agency enforces legislation against the use of explosives, poisonous substances, etc., for the purpose of catching, killing, taking or harming fish (1955 Cumulative Supplement, Title 45, Section 703).

WATER PURVEYORS

The general responsibility for the purity of water is shared by health authorities, water purveyors, owners of property, and water users. Those duties of health authorities and other agencies are presented above. The purveyor of water must safeguard it while in the water supply system, with some overlapping responsibilities with the property owner once the water reaches the property line.

Georgia State Board of Health Regulations provide that all persons, companies, and corporations manufacturing, importing, or bottling water in the State of Georgia, whether artificial, natural, mineral, spring, or other water for drinking purposes, must first

file with the Georgia State Board of Health the name of such water and the exact location from which it is obtained. They also must first have made a bacteriological examination, and a chemical analysis if required by the State Board of Health Laboratory.

DESCRIPTION OF THE BASIN

GENERAL

The Ogeechee Basin, which is entirely within the State of Georgia, covers an area of 5,436 square miles. It is bounded on the north by the Savannah Basin, on the west by the Oconee Basin, on the south by the Altamaha Basin and on the east by the Atlantic Ocean. The Basin extends from Union Point at its north-western limit to Savannah and the Atlantic Ocean to the east. A large portion of Chatham County and approximately one-third of the City of Savannah lie within the Basin.

The Ogeechee River rises in Greene County and flows in a southeasterly direction to Ossabau Sound. Although the headwaters are in the Piedmont Province, the river flows for all but a short part of its length across the Coastal Plain. The Canoochee River is the major tributary and enters the Ogeechee River near the mouth. The width of the Ogeechee River varies from a few feet at the headwaters to approximately 250 yards at the mouth. The Ogeechee River is bordered throughout most of its length by swamp forests and the upland portions of the Basin consist of pine forests and farmland.

A visual inspection of the Ogeechee River from its beginning near Union Point to its mouth near Savannah, indicates that turbidity is low and the color of the water ranges from light to dark. Both the color and the turbidity of the river are mainly attributable to the type of terrain it drains, as there is little visible evidence of pollution from municipal and industrial wastes except in the extreme upper reaches. One instance of noticeable industrial pollution was observed in Greene County, where an industrial plant was discharging a highly colored waste that caused distinct discolorations in the receiving stream for some distance below the outfall.

Except for 2,913 farm ponds with a total surface area of 11,394 acres, the impoundment of surface waters in the Basin is negligible. There are no municipal or industrial water impoundment reservoirs. No Federal or State storage or flood control reservoirs are located in this Basin and no plans are presently underway for building such projects.

CLIMATE AND HYDROLOGY

The climate of the Basin is mild, the mean annual temperature varying from 64° F in the northern part to 67° near the coast. Average annual rainfall is about 46 inches for the Basin as a whole. The annual rainfall in the Piedmont Province varies from 45 to 59 inches, while in the Lower Coastal Plain it varies from 45 to 52 inches. The frost free growing season averages from 220 to 270 days, depending on latitude.

The 20 year record (1937-57) of the Ogeechee River gauging station at Eden, Georgia, where the drainage area is 2,650 square miles, shows a 24-hour maximum discharge of 26,300 cfs, a minimum discharge of 131 cfs, and an average discharge of 2,095 cfs. The Canoochee River near Claxton, Georgia, where the drainage area is 555 square miles, has an average 24-hour discharge of 397 cfs, a maximum discharge of 12,100 cfs, and a minimum discharge of 0.86 cfs for the period 1937-57.

GEOLOGY

The extreme upper portion of the Ogeechee Basin, about 4.5 percent of the total area, lies within the Piedmont Physiographic Province. This Province is underlain by metamorphic and igneous rocks, commonly known as crystalline rocks. Deformation in the metamorphic formation has produced primary structural planes that are important to the circulation of ground water. The horizontal joint planes are conducive to the accumulation and storage of ground water in the low areas and to drainage of water from beneath hills. Above the solid formations is a mantle of weathered soil which serves both as an aquifer for shallow wells and as a medium for collecting and storing water from precipitation and feeding it into the cracks in the underlying rock formations.

The major portion (95.5 percent) of the Basin, from near Jewell to the Atlantic Ocean, lies within the Coastal Plain Physiographic Province. This Province is underlain by stratified sediments which form a southeastward and southwestward thickening wedge overlying the crystalline basement rocks. The basement rock formation is an extension of those of the Piedmont Province. Along the fall line at the junction of the Piedmont and Coastal Plain Provinces, sand and gravel constitute the important water aquifer, commonly known as the Cretaceous Aquifer. In the remaining lower portion of the Basin, ground water is obtained from the limestone aquifer which is one of the most productive aquifers in the United States. Above and below the limestone aquifer are beds of low permeability that confine the water. The upper confining bed is referred to as Hawthorn clay and the lower bed as McBean clay. Outcrop areas in Effingham and Jenkins Counties serve as recharge areas for the

limestone aquifer. Recharge occurs downward through the exposed rock and sink holes in the limestone. In the vicinity of the fall line, where the limestone is underlain and overlain by sands, recharge takes place upward and downward from these sand units to the limestone aquifer.

POPULATION

The population of the Basin, according to census figures for 1960 is 201,500. This represents an increase of 29,200 from 172,300 reported in the 1960 census, and an increase of 22,300 from the reported 179,200 in 1940. The urban population increased by 72 percent during the 1950-60 decade, while the rural population decreased slightly. Counties in the Lower Coastal Plain increased in total population while all other counties decreased.

There are seven communities in the Basin which meet the urban definition established by the Bureau of the Census. These with their 1960 populations, are: Claxton, 2,672; Fort Stewart, 4,500; Hinesville, 3,174; Hunter Air Force Base, 5,560; Millen, 3,633; Statesboro, 8,356 and a portion of the city of Savannah which had an estimated 1960 population of 61,700. Seven other communities having populations between 1,000 and 2,500 in 1960 are: Louisville, Metter, Pembroke, Twin City, Union Point, Wadley, and Warrenton.

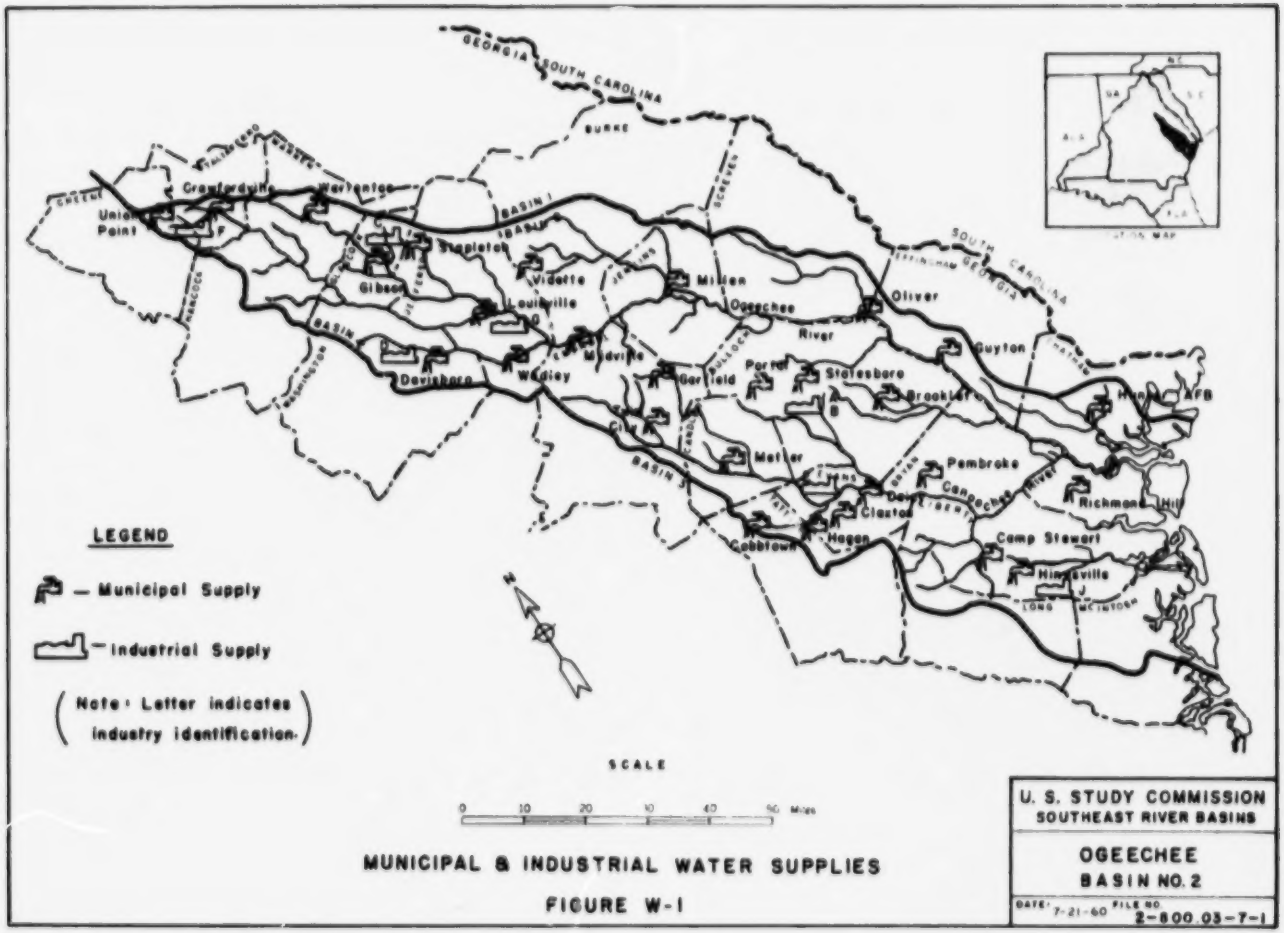
RESOURCES

The principal natural resources of the Basin are water, soils, kaolin, and timber. The Basin is mainly an agricultural area, the major products being corn, peanuts, cotton, tobacco, hogs, and cattle. The timber resource supports small pulpwood, wood products, and naval stores.

The Ogeechee River is not used for commercial shipping but it is unique among Georgia Rivers in that a major railroad runs along the greater part of the length of its valley. This combination of rail transportation and industrial water availability may have some bearing on future industrial development in the valley.

There are 11 established commercial fishing camps in the Basin. Waters of the streams and rivers in the Basin are used extensively for boating, swimming and sport fishing, and water skiing is practiced in the lower reaches.

MUNICIPAL, INDUSTRIAL AND DOMESTIC WATER SUPPLIES



MUNICIPAL & INDUSTRIAL WATER SUPPLIES

FIGURE W-1

INTRODUCTION

SCOPE OF MEMORANDUM

This memorandum contains data and information concerning the present status of municipal, domestic, and industrial water supply systems in the Ogeechee Basin. Although part of the City of Savannah is in the Ogeechee Basin, the city's municipal water is furnished by one system whose source is located in the Savannah Basin. The industrial water is also secured from the Savannah Basin. Therefore, this memorandum will not consider municipal or industrial water supplies for Savannah. They will be treated in the Savannah Basin memorandum. Projected future water requirements for the years 1975 and 2000 are also presented, as are suggested solutions to present and anticipated future inadequacies. In connection with these solutions, an appraisal of the benefits to be derived from the proposed program and the annual cost of water are included. Time did not permit a study of the effects of the uncontrolled free-flowing wells which are found in the coastal area of the Basin.

PROCEDURES AND INVESTIGATIONS

Existing data on water demand and availability were obtained from reports, records, and correspondence of the Georgia Department of Public Health, U. S. Department of Agriculture, Georgia State Chamber of Commerce, the Georgia Department of Commerce, and other Federal and State agencies. Where data were found to be lacking or out-dated, extensive field investigations were conducted by the Georgia Department of Public Health, and data were submitted to the U. S. Public Health Service for inclusion in this memorandum. The field investigations by the Georgia Department of Public Health included visits to municipalities, small communities, industries, institutions, and domestic water users.

Data were obtained regarding the 28 existing municipal water supply systems in the Basin and carefully studied to establish both the present and future water requirements and water supply needs. The extent of the field study was not sufficient to obtain data on semi-public supplies. Therefore, no data are available for this Basin.

Little information was available concerning the large number of existing domestic water supply systems. Therefore, field visits were made to 137 farm and rural non-farm residences to secure the necessary data. A random sampling method, based on rural dwelling density, was employed in this field work; an average of one domestic supply in each 35 square miles of the Basin was visited. The 137 installations surveyed represent about one percent of the total estimated number of domestic supplies in the Basin.

Data on industrial water usage were obtained from the municipality furnishing the water, or when an industrially owned water supply system was involved, from the industry itself. The eight industrially owned water supply systems visited use water for canning, poultry processing, meat packing, textile, manufacturing, and metal fabrication. Figure W-1 shows the location of existing municipal and industrial water supplies in the Ogeechee Basin.

BASIC ASSUMPTIONS

Populations of individual municipalities have been projected using the average rate of growth which has occurred during the past 30 years. Preliminary 1960 Census figures were used for municipalities with populations over 1,000 and estimated 1960 figures were used for communities with populations under 1,000. Municipalities with populations of 1,000 or more had an average growth rate of about 1.7 percent per year and those under 1,000 grew at the rate of about 1.0 percent per year. These values were used in projecting populations to 1975 and 2000.

For the purpose of this memorandum, future water demands were determined using these projected populations and an estimated per capita water use. The 1975 needs were determined by using an estimated water demand of 100 gallons per capita per day in municipalities of 1,000 or more. The 2000 needs are based on an estimated water demand of 150 gallons per capita per day in municipalities of less than 1,000 and 200 gallons per day in municipalities of 1,000 and above.

Projections of the industrial water demands were made on the assumption that six of the industries processing agricultural products would expand production 20 percent by 1975 and 50 percent by 2000. It was also assumed that their water requirements would increase by the same percentages.

Water supply system costs have been estimated on the basis of per capita cost data developed by the Public Health Service and adjusted on the basis of January 1, 1960 Engineering News Record Construction Cost Index for Atlanta, Georgia.

Annual equivalent capital costs, annual operation and maintenance costs, and replacement costs of existing and needed water supply facilities were estimated on the basis of January 1, 1960 constant dollars. Interest rates of 4½ percent were used for determining annual costs for municipal, industrial, and domestic water supply.

(10/2/61)

QUANTITY AND QUALITY OF WATER AVAILABLE FOR WATER SUPPLIES

SURFACE WATER

The only major streams in the Basin are the Ogeechee and Canoochee Rivers. The average flow (1937-1949) in the Ogeechee River at Louisville, Georgia was 867 cfs or 0.70 mgd per square mile of drainage area. Downstream at Eden, Georgia the average discharge was 2037 cfs or 0.50 mgd per square mile for the same years. The average discharge of the Canoochee River at Claxton, Georgia was 397 cfs or 0.47 mgd per square mile during the same 20-year period.

At the present time, surface water is not extensively used for municipal, industrial, or domestic water supplies; however, one municipality and three industries use surface water to supplement well supplies.

Data on surface water quality in the Basin were quite limited. Only chemical quality data were available at five stations, two of which were located on the main stem of the Ogeechee. These data, which are found in the report on Water Quality Basic Data, showed that total dissolved solids ranged from 23 to 66 ppm and with the possible exception of iron, the mineral constituents reported were low. Iron concentrations in excess of 0.3 ppm were reported at two of the stations in the upper portion of the Basin. The alkalinity of the waters was consistently below 30 ppm and the hardness did not exceed 25 ppm.

In anticipation of gaps in existing surface water quality data, four sampling stations were established throughout the Basin by the Public Health Service and field studies were conducted during November 1960, January and February 1961, and June 1961. The average dissolved oxygen reported at three stations on the Ogeechee River during the fall and winter studies exceeded 85 percent of saturation. However, during the summer studies, the average dissolved oxygen ranged from 63.9 to 70.9 percent of saturation. The average dissolved oxygen reported at the Canoochee River station ranged from 57.1 to 86.4 percent, the minimum being recorded during the fall survey. The median coliform concentration reported at all stations in the Basin ranged from 590 to 3350 MPN per 100 ml. The total organic nitrogen reported at the three stations on the Ogeechee River never exceeded 0.5 ppm, whereas the Canoochee River Station reported average concentrations ranging from 0.54 to 0.64. Total phosphate appeared to be insignificant at all stations. Average alkalinity did not exceed 50 ppm.

GROUND WATER

Ground water is relatively abundant except for the small area of the Basin which lies in the Piedmont Province. In this Province, records indicate that the average yield of municipal drilled wells, which must rely upon fissures in the metamorphic and igneous rocks, is 20 gpm (0.03 mgd). In the Coastal Plains Province, wells draw upon the Cretaceous and limestone aquifers and have yielded from 100 gpm (0.15 mgd) to 4,000 gpm (6.0 mgd). The aquifers used for ground water supplies are discussed under "Geology" in the General Introduction. All 28 communities and all industries having their own supply systems utilize ground water sources for all or a portion of their water.

Chemical and physical analyses of ground water were available at nineteen stations throughout the Basin as shown in the report on Water Quality Basic Data. Generally ground water is of such quality that little or no treatment would be necessary to comply with the chemical requirements of the Public Health Service "Drinking Water Standards". In the Coastal Plains Providence, the total dissolved solids ranged from 89 to 225 ppm. Iron concentration ranged from 0.0 to 7.8 ppm with 6 stations reporting concentrations in excess of 0.3 ppm. Alkalinities ranged from 32 to 146 ppm and total hardness from 42 to 132 ppm. Water from the rock and sand aquifers of the Piedmont Province appeared to be less mineralized and softer than the limestone water. There were no reported cases of contamination of ground water aquifers by either manmade wastes or salt water intrusion.

Several municipalities have reported the presence of hydrogen sulfide gas in ground water resulting in the typical "rotten egg" odor. No analytical data areavailable to indicate the extent of this problem.

MUNICIPAL WATER SUPPLIES

INVENTORY

There are 28 communities in the Basin with municipal water supply systems. Warrenton utilizes both ground and surface water for its municipal supply while all the others use only ground water.

The three Piedmont Physiographic Province municipalities of Union Point, Crawfordville, and Warrenton use deep wells with depths ranging from 400 to 1200 feet. Eighteen municipal supplies in the Upper Coastal Plains Physiographic Province are from wells ranging in depth from 90 to 760 feet. The remaining seven municipal supplies are located in the Lower Coastal Plains Physiographic Province and are wells with depths ranging from 150 to 816 feet. Additional information regarding the supply systems is shown in Table W1.

(10/2/61)

TABLE W1
BASIC DATA ON MUNICIPAL WATER SUPPLY SYSTEMS
OGEECHEE BASIN

Municipality	1960 Population	Population Served	Source	Treatment	Design Capacity mgd	Storage mg	Average mgd	Demand gpcd	Percent used by Industry
Brooklet	557	600	wells	none		0.060	0.060	100	
Claxton	2,672	2,670	wells	Dc		0.195	0.225	82	5
Cobbtown	280	250	wells	Dh		0.005	0.013	52	
Crawfordville	786	800	wells	none		0.075	0.030	38	3
Daisy	229	120	well	none		0.005	0.004	33	
Davisboro	417	545	wells	none		0.065	0.040	73	
Garfield	225	200	well	none		0.005	0.006	28	
Gibson	479	550	well	DhCo		0.060	0.022	40	10
Guyton	670	750	wells	Dc		0.065	0.054	72	
Hagan	552	520	well	none		0.015	0.060	87	3
Hinesville	3,174	3,160	wells	Dc		0.010	0.500	125	
Louisville	2,413	2,856	wells	Dc	2.0	0.150	0.300	91	
Metter	2,362	2,350	wells	none		0.075	0.200	85	5
Midville	676	700	wells	Dc		0.130	0.100	143	25
Millen	3,633	2,990	wells	none		0.260	0.450	112	5
Oliver	192	200	well	none		0.015	0.020	100	
Pembroke	1,450	1,375	wells	none		0.075	0.137	100	
Portal	494	640	wells	none		0.035	0.070	109	5
Richmond Hill	800	650	wells	none		undet.	0.025	38	
Stapleton	356	625	well	DhCo		0.060	0.020	32	
Statesboro	8,356	8,385	wells	DcV	3.0	0.840	0.750	94	
Twin City	1,095	1,015	well	none		0.450	0.051	50	5-10
Union Point	1,615	1,610	wells	none		0.075	0.140	78	
Vidette	103	80	well	none		0.001	0.006	75	
Wadley	1,898	1,830	wells	Dc	0.58	0.170	0.200	109	
Warrenton	1,770	1,760	Wells & Rocky Comfort Creek	CalDcMbsFrs	0.15	0.075	0.200	114	2
Ft. Stewart	4,500	4,500	wells	Dc		0.300	1.400	312	
Hunter Air Force Base	5,560	5,560	wells	DcV		1.150	0.940	172	
Totals	47,314	47,291					6.017	127	

(10/2/61)

Six of the communities conform to the urban definition established by the Bureau of the Census. These are Claxton, Fort Stewart, Hunter Air Force Base (Military Installations), Hinesville, Millen, and Statesboro. Most of 27,895 persons in these communities are served by municipal water supply systems. Seven communities having populations of 1,000 to 2,500 are Louisville, Metter, Pembroke, Twin City, Union Point, Wadley, and Warrenton. Of the total 12,603 inhabitants in these seven communities, 94 percent are served with municipal water. Louisville furnishes municipal water service to all of its people as well as 450 consumers residing outside the corporate limits of the city. The remaining 15 communities have populations of less than 1,000 and most serve 100 percent of their inhabitants. The exceptions are Garfield which furnishes water to 89 percent, Hagan which serves 95 percent, and Richmond Hill which serves only 65 percent of its population.

The total population of the 28 communities is 47,314, and the average municipal water consumption is 6.02 mgd or 127 gallons per capita per day (based on yearly consumption). For comparison the Senate Select Committee on National Water Resources reported the 1954 water use in the Southeast to average 116 gallons per capita per day. The maximum daily demand is 187 percent of the average day; and the maximum monthly demand is 140 percent of the average month. Approximately 3 percent of the total municipal water consumption is used for industrial purposes.

PRESENT STATUS OF WATER SUPPLY SYSTEMS

Twenty-six of the municipal supply systems are publicly owned and two are privately owned. All utilize ground water exclusively except for Warrenton which supplements its well supply with water taken from Rocky Comfort Creek. All plants have periodic bacteriological examinations made of the water supplied to the public. Thirteen municipalities use chlorine to disinfect the water supplied to their 33,600 users. The other 15 municipalities, serving about 13,700 people, have supplies which have proven bacteriologically satisfactory up to the present time without disinfection. Warrenton treats its surface water in a conventional rapid sand filtration plant. Gibson and Stapleton provide treatment for the reduction of iron and hardness and Statesboro and Hunter Air Force Base adjust the fluoride content.

WATER SUPPLY SYSTEM REQUIREMENTS FOR 1960

Although six municipalities reported improvements needed for their present water supply systems, a study of the basic data indicates that nineteen of the municipalities could strengthen or improve their water supply systems.

(10/2/61)

These needs, as shown in Table W2, include wells for 3 communities, disinfection for 15, aeration for 6, storage facilities for 3, and distribution system extensions to serve 1700 people in 13 communities.

Table W2
MUNICIPAL WATER SUPPLY SYSTEMS
ESTIMATED NEEDS AND COSTS*FOR 1960
OGEECHEE BASIN

Municipality	Estimated Costs in $1,000				
	Source	Treatment	Storage	Dist. System	Total
Brooklet	--	2	--	5	7
Claxton	12	8	--	23	43
Crawfordville	--	4	--	4	8
Daisy	12	2	--	6	20
Davisboro	--	2	--	25	27
Garfield	--	2	--	2	4
Gibson	--	--	--	10	10
Hagan	--	4	--	1	5
Hinesville	--	2	--	--	2
Metter	--	2	--	--	2
Millen	--	11	--	--	11
Oliver	--	2	--	--	2
Pembroke	--	8	--	--	8
Portal	--	4	25	3	32
Richmond Hill	--	2	25	8	35
Stapleton	--	--	--	5	5
Twin City	--	10	--	3	13
Union Point	12	16	--	--	28
Vidette	--	4	4	6	14
Totals	36	85	54	101	276

*Costs are based on January 1960 constant dollars.

PROJECTIONS

Tables W3 and W4 show the projected municipal water demands for the years 1975 and 2000, respectively. By 1975, 31 municipalities in the Basin will have an estimated total water demand of 9.07 mgd. These communities will supply an estimated population of 57,700. By the year 2000, the same municipalities will supply an estimated population of 72,800 whose total water demand will be 14.4 mgd.

(10/2/61)

TABLE W3
MUNICIPAL WATER SUPPLY SYSTEMS
PROJECTED NEEDS AND COSTS* FOR 1975
OGEECHEE BASIN

Municipality	Est. 1975 Pop. Served	Est. Water Demand mgd	Estimated 1975 Costs in $1,000			
			Source and Treat.	Storage	Dist. System	Total
Bartow	400	0.040	14	27	23	64
Brooklet	690	0.070	--	--	5	5
Claxton	3,350	0.500	--	--	49	49
Cobbtown	290	0.030	--	25	3	28
Crawfordville	920	0.090	12	--	6	18
Daisy	140	0.015	--	--	1	1
Davisboro	560	0.055	--	--	5	5
Eden	460	0.045	14	29	23	66
Fort Stewart	4,500	1.400	--	--	--	--
Garfield	260	0.025	--	25	3	28
Gibson	630	0.065	14	--	5	19
Guyton	800	0.080	--	--	6	6
Hagan	630	0.065	--	25	5	30
Hinesville	4,000	0.600	--	47	48	95
Hunter AFB	5,560	0.940	--	--	--	--
Louisville	3,000	0.450	--	--	34	34
Metter	3,000	0.450	--	47	37	84
Midville	800	0.080	--	--	6	6
Millen	3,800	0.570	--	--	46	46
Oliver	230	0.025	--	--	2	2
Pembroke	1,850	0.280	12	35	23	70
Portal	700	0.070	--	--	6	6
Richmond Hill	1,250	0.190	--	37	14	51
Stapleton	750	0.075	--	--	6	6
Statesboro	10,500	1.600	--	--	131	131
Stillmore	480	0.050	14	27	4	45
Twin City	1,400	0.210	12	--	17	29
Union Point	2,000	0.300	32	27	23	32
Vidette	115	0.010	--	18	1	19
Wadley	2,400	0.360	--	--	31	31
Warrenton	2,200	0.330	60	29	26	115
Totals	57,665	9.070	184	398	589	1,171

*Costs are based on January 1960 constant dollars.

(10/2/61)

TABLE W4
MUNICIPAL WATER SUPPLY SYSTEMS
PROJECTED NEEDS AND COSTS* FOR 2000
OGEECHEE BASIN

Municipality	Est. 2000 Pop. Served	Est. Water Demand mgd	Estimated 2000 Costs in $1,000			
			Source and Treat.	Storage	Dist. System	Total
Bartow	500	0.075	--	--	6	6
Brooklet	840	0.125	--	--	9	9
Claxton	4,500	0.900	--	56	67	123
Cobbtown	350	0.055	--	--	4	4
Crawfordville	1,120	0.225	20	--	12	32
Daisy	170	0.025	--	16	2	18
Davisboro	680	0.100	--	--	7	7
Eden	560	0.085	14	--	6	20
Fort Stewart	4,500	1.400	--	--	--	--
Garfield	320	0.050	--	--	4	4
Gibson	770	0.115	14	--	8	22
Guyton	980	0.145	--	--	--	10
Hagan	770	0.115	--	--	8	8
Hinesville	5,500	1.100	--	56	87	143
Hunter AFB	5,560	0.440	--	--	--	--
Louisville	4,000	0.800	--	70	58	128
Metter	4,000	0.800	--	56	58	114
Midville	980	0.145	14	--	10	24
Millen	5,000	1.000	20	47	69	136
Oliver	280	0.040	--	--	3	3
Pembroke	2,500	0.500	20	35	38	93
Portal	850	0.130	--	--	9	9
Richmond Hill	1,700	0.340	--	35	26	61
Stapleton	910	0.140	14	--	9	23
Statesboro	14,000	2.800	--	86	202	288
Stillmore	600	0.090	--	--	7	7
Twin City	1,850	0.370	20	29	27	76
Union Point	2,700	0.540	24	38	40	102
Vidette	140	0.020	14	--	2	16
Wadley	3,200	0.640	--	47	46	93
Warrenton	3,000	0.600	102	47	46	195
Totals	72,830	14.410	276	618	880	1774

*Costs are based on January 1960 constant dollars.

(10/2/61)

FUTURE WATER SUPPLY REQUIREMENTS

Except for the Piedmont Province, there appears to be ample ground water in the Basin for present and anticipated future water needs. Water is available near points of use and with the possible exception of Union Point no special impoundments or transporation facilities will be required to supplement sources of supply. Union Point may have to develop a surface water supply. However, for the purpose of estimating costs, it has been assumed that Union Point will construct additional wells that will produce the same amount of water as existing wells. If this is not possible, it will have to develop a surface supply at a higher cost.

The municipal water system needs anticipated for 1975, assuming 1960 recommendations have been met, can be satisfied as follows. Eight municipalities can meet increased demand by constructing wells, and one by additional surface water intake and treatment facilities; and the 13 municipalities requiring additional storage facilities can erect elevated tanks. Four municipalities can provide disinfection facilities and one can provide aeration. Additional distribution facilities can be provided by 29 municipalities to meet distribution needs.

Municipal needs by the year 2000, assuming 1975 recommendations have been satisfied, can be met in the same manner. Ten of the eleven municipalities that require additional source needs can install additional wells and the other city can add to its surface water treatment and intake facilities. Storage needed by 13 municipalities can be provided by tanks. Extension of mains will satisfy the distribution needs of 28 communities. Nine chlorinators will satisfy disinfection needs in nine communities.

PRESENT WATER RATE STRUCTURE

Water rates charged by the municipalities in the Basin are the same for industrial and individual users. One municipality charges a flat rate of $2.50 for all water used regardless of quantity. The other municipalities have minimum rates ranging from $2.00 for the first 4,000 gallons to $3.50 for the first 2,000 gallons. Rates for the next 50,000 gallons varies from 15 cents to 80 cents per 1,000 gallons. The rates gradually reduce until a minimum of 6 cents to 50 cents per 1,000 gallons is reached for quantities over 250,000 gallons.

ANNUAL COSTS

The annual cost of providing water to municipal users in the Ogeechee Basin in 1960 is estimated to be $546,500. This cost, based on the cost of existing facilities, is given below:

Annual equivalent capital cost	$269,000
Annual replacement cost	$ 17,000
Annual operation and maintenance cost	$260,500
Total annual cost (1960)	$546,500

The installation costs of additional municipal water supply facilities needed to meet water requirements for 1960, 1975, and 2000 have been estimated. These costs, based on January 1960 constant dollars, are shown in Tables W2, W3, and W4.

The total capital cost of improving the existing municipal water supply facilities in 1960 is estimated to be $276,000. The expenditure of this amount of money will strengthen the existing municipal water systems of the Basin and provide adequate service.

By 1975, additional expenditure of monies will be necessary to improve water supply systems and meet the demands of the increased number of users. The capital cost of providing the additional necessary improvements by 1975 is estimated to be $1,171,000. This includes $184,000 for improvement of sources and treatment, $398,000 for storage facilities, and $589,000 for distribution facilities.

The annual cost of providing water to municipal users by 1975 is estimated to be $761,800. This includes annual equivalent capital cost of: existing facilities in 1960, the capital requirement of improvements needed in 1960, the capital cost of additional improvements required from 1960 to 1975, the replacement cost based on total investment by 1975, and the operation and maintenance on the total installed systems in 1975. A breakdown of this annual cost is given below:

Annual equivalent capital cost	$339,300
Annual replacement cost	$ 24,500
Annual operation and maintenance cost	$398,000
Total annual cost (1975)	$761,800

By the year 2000, municipal growth will have reached the point that water supply facilities will require an additional estimated capital expenditure of $1,774,000 to raise them to the necessary capacity. This includes $276,000 for source improvement and treatment facilities, $618,000 for storage capacity, and $880,000 for extension of distribution facilities.

The annual cost of providing water to municipal users by 2000 is estimated to be $1,086,100 assuming that all needs have been met by the year 2000. A breakdown of this annual cost is given below:

Annual equivalent capital cost	$ 425,500
Annual replacement cost	$ 28,200
Annual operation and maintenance cost	$ 632,400
Total annual cost (2000)	$1,086,100

(10/2/61)

BENEFITS

The availability of an abundant supply of good quality water determines to a considerable extent the degree of community and industrial development.

A properly designed and operated water supply system protects the health of the community and strengthens its fire defenses. It contributes to recreational activities by providing water for swimming pools, parks, playgrounds, and golf courses. It improves community esthetics and health by providing water to flush streets, keep lawns and gardens green, and keep down dust carried disease organisms.

The value of water to the users is the measurement of benefits from community water supply systems. These benefits are measured by assuming that the value of water in adequate quantity and quality to the users is equal to the cost of obtaining water of similar quality from the most likely alternative source. In the Ogeechee Basin, engineering data are not available on alternative surface sources; and, in general, ground-water sources are the most likely alternative because of adequately yielding aquifers. Therefore, benefits from additional ground-water sources are considered to be equal to the cost of obtaining water from ground water giving a benefit-cost ratio of unity.

DOMESTIC WATER SUPPLIES

INVENTORY

The rural farm and non-farm population which is not served by municipal water systems was 92,500 in 1960. The field survey of 137 rural dwellings in the Basin showed that the average number of persons served by each domestic water system is 6.2 and that the average water consumption is 48 gpcd. This indicates that the total number of domestic water system in the Basin is 14,900 whose total water pumpage is 4.4 mgd. Table W5 is a summary of the results of the field survey.

PRESENT STATUS OF WATER SUPPLY DEVELOPMENT

The field survey showed that approximately 11 percent of the domestic water system served more than one dwelling. Seventy-seven percent of the system were pressurized and seven percent reported their wells inadequate during dry periods. Sixty-seven percent of the system surveyed did not meet accepted sanitary standards due generally to inadequately sealed wells. All except one of the systems surveyed utilized wells as their source of supply. The various sources used are discussed individually below.

(10/2/61)

Drilled wells: The survey indicates that 45 percent or 6700 domestic water systems utilize drilled wells. All drilled wells were equipped with power pumps. The depths of the wells ranged from 70 to 780 feet and all were reported adequate to meet the demand. Ninety-five percent met accepted sanitary standards. Several owners reported objectional hardness, iron content, and/or sulfur taste.

Dug wells: The survey indicates that 45 percent or 6700 domestic water systems utilize dug wells. Sixty-two percent were equipped with power pumps. The depths ranged from 12 to 60 feet and 18 percent were reported inadequate to meet peak demands during dry months. Fifty percent of the dug wells did not meet accepted sanitary standards and several owners reported objectional hardness, corrosiveness, color, iron content, or turbidity.

Bored wells: The survey indicates that 5 percent or 750 of the domestic system utilize bored wells. Thirty percent were equipped with power pumps. The survey indicates that 5 percent or 750 of the domestic system utilize bored wells. Thirty percent were equipped with power pumps. The depths ranged from 18 to 145 feet. All were reported adequate to meet demands and 80 percent met accepted sanitary standards.

Driven wells: The survey indicates that 4 percent or 600 of the domestic system utilize driven wells. All were located in the lower coastal plain of the Basin and the depth ranged from 30 to 70 feet. Several owners reported excessive iron and/or sulfur taste.

Springs: It is estimated that approximately 150 domestic systems depend upon springs as their source of supply.

WATER SUPPLY SYSTEM REQUIREMENTS FOR 1960

The cost of improving existing domestic water supply systems to meet accepted sanitary standards is estimated to be $1,880,000. This includes the installation cost of 3,400 pressure systems, sanitary seals for 335 drilled wells and 150 bored wells, concrete platforms and seals for 3350 dug wells, and improvements to 150 springs.

FUTURE WATER SUPPLY SYSTEM REQUIREMENTS

The farm and rural non-farm population which will not be served by municipal water systems is expected to decrease sharply in the future. By 1975 the population served by domestic water supply systems will have decreased to 60,300, and the average water demand will be 4.2 mgd based on 70 gpcd. Between 1975 and 2000 the population is expected to decrease to 26,900 and the average water demand will be 2.7 mgd based on 100 gpcd.

(10/2/61)

TABLE W5
BASIC DATA ON DOMESTIC WATER SUPPLY SYSTEMS
OGEECHEE BASIN
Based on sample survey of 137 systems
serving 178 rural dwellings

	Description	Number	Percentage of total
Type	Rural Farm	99	72
	Rural Non-farm	38	28
Source	Dug Wells	62	45
	Bored Wells	7	5
	Drilled Wells	62	45
	Driven Wells	5	4
	Springs	1	1
Quantity	Adequate	127	93
	Inadequate	10	7
Quality	Occasional Turbidity	6	5
	Corrosiveness	3	2
	Undesirable Hardness	26	19
	Undesirable Iron Content	6	5
	Sulfur Taste and/or Odor	13	10
Construction	Meet accepted sanitary standards	91	67
	Do not meet accepted sanitary standards	46	33
	Pressure System	106	77
	Hand Pumps or Buckets	31	23
	Serves More Than One Dwelling	15	11

The water demand by domestic users ranges from 10 to 325 gpcd. The average usage was found to be 48 gpcd. The average number of people served by each domestic water system was found to be 6.2 and the average number of people per dwelling was found to be 4.8.

(10/2/61)

ANNUAL COSTS

The present and future needs of the farm and rural non-farm domestic water system will be met on an individual basis. Each owner will develop his water system to meet his needs in accordance with his financial ability to do so.

The annual costs of providing water in 1960 to the rural population not on municipal water system in 1960 is estimated to be $1,207,700 as shown below:

Annual equivalent capital cost	$ 618,300
Annual replacement cost	$ 365,400
Annual operation and maintenance cost	$ [illegible],000
Total annual cost (1960)	$1,207,700

The annual costs are assumed to decrease in proportion to the decrease in Basin population served by domestic systems. By 1975 and 2000, the annual cost will be $785,000 and $350,000 respectively.

INDUSTRIAL WATER SUPPLIES

INVENTORY

Data secured by field surveys of eight industrial water systems are presented in Table W6. Six of these industries depend entirely on their own sources for all water used while two industries supplement their supplies with municipal waters. The total industrial water consumption in the Basin is estimated to be 0.62 mgd based on a yearly average. This includes 0.39 mgd furnished by industrially owned sources and 0.23 mgd furnished by municipal water supply systems.

Surface water is used by one textile mill for process water and by two canneries for cooling water. Wells provide drinking water for six industries, process water for eight, and cooling water for three.

The eight industries inventoried are engaged either in the processing of food, manufacture of textiles, or metal fabrication.

PRESENT STATUS OF WATER SUPPLY DEVELOPMENT

The eight industrial plants with privately owned water supply systems use approximately 0.39 mgd from their sources and 0.05 mgd from municipal sources. Ground water provides for 90 percent of this demand, and about 10 percent is obtained from surface supplies. The field survey indicated that these sources are adequate to meet present demand.

(10/2/61)

TABLE W6
BASIC DATA ON INDUSTRIAL WATER SUPPLY SYSTEMS
OGEECHEE BASIN

County	Ind. Code	Type of Industry	No. of Emp.	WATER SUPPLY									Total Plant Demand mgd
				Drinking & Sanitation			Process & Boiler			Cooling			
				Source	Treat-ment	Ave. mgd	Source	Treat-ment	Ave. mgd	Source	Treat-ment	Ave. mgd	
Bulloch	A	meter mfg.	305	well	none	--	well	none	--	well	none	--	undet.
	B	meat pk.	60	well	none	--	well	none	--	--	--	--	0.050
Glascock	C	canning	65	city	none	0.014	wells	none	0.036	stream	Dh	--	0.050
Washington	D	canning	76	well	none	--	well	none	--	lake	none	--	0.120
Evans	E	poultry pro.	75	well	none	--	well	none	--	well	soften	--	0.090
Greene	F	textile	450	city	--	0.001	well & stream	soften	0.050	--	--	--	0.100
Jefferson	G	meat pk.	2	well	none	--	well	none	--	--	--	--	0.001
Liberty	J	meat pk.	20	well	--	--	well	--	--	well	--	--	0.025
TOTALS			1,053										0.436

QUALITY

One industry reported operating difficulties due to algae in its surface water supply. Four of the industries reported their ground water supplies to contain excessive hardness. One textile mill softens its process water, the poultry plant softens its boiler-feed water, and one of the canneries chlorinates surface water used for cooling purposes. No other treatment of industrial water was reported indicating that water quality is generally satisfactory.

FUTURE WATER SUPPLY REQUIREMENTS FOR 1975 AND 2000

Industrial water use by 1975 and 2000 is estimated to be 0.53 mgd and 0.68 mgd respectively. Table W7 gives these projected demands plus water system needs for 1975 and 2000. The existing industrial water supply systems appear to be adequate for anticipated demands by 1975 and 2000 with one exception. This exception is a canning plant which will need to provide an additional well by 1975.

TABLE W7
PROJECTED INDUSTRIAL WATER REQUIREMENTS FOR 1975 AND 2000
OGEECHEE BASIN

County and Industry Code		Type of Industry	Estimated 1975 Requirements mgd	Estimated 2000 Requirements mgd
Bulloch	B	Meat Packing	0.06	0.08
Glascock	C	Canning	0.04*	0.05
Washington	D	Canning	0.14	0.18
Evans	E	Poultry Pro.	0.20	0.25
Greene	F	Textile	0.06	0.08
Liberty	J	Meat Packing	0.03	0.04
Totals			0.53	0.68

*The estimated 1975 cost of one additional well to meet additional demand is $12,000, based on January 1960 constant dollars.

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ANNUAL COSTS

The additional installation cost of providing adequate industrial water supply systems in the Basin for the period 1960 to 1975 is estimated to be $12,000. No additional facilities will be needed by 2000.

Existing industrial water supply systems are reported to be adequate for 1960 needs. The annual cost of providing industrial water in 1960 from existing supplies is estimated to be $30,940. A breakdown of this cost is given below:

Annual equivalent capital cost	$20,830
Annual replacement cost	$ 1,510
Annual operation and maintenance cost	$ 8,600
Total annual cost (1960)	$30,940

By 1975 one industry will need to spend $12,000 for improving its source of supply. The annual cost of providing the necessary industrial water by 1975 is estimated to be $32,100. A breakdown of this cost is given below.

Annual equivalent capital cost	$21,450
Annual replacement cost	$ 1,650
Annual operation and maintenance cost	$ 9,000
Total annual cost (1975)	$32,100

The water supplies and facilities that will be available in 1975 are estimated to be adequate for 2000 and no additional capital cost will be necessary. The annual cost of providing the industrial water needed by 2000 is estimated to $34,050. A breakdown of this cost is given below:

Annual equivalent capital cost	$21,450
Annual replacement cost	$ 1,650
Annual operation and maintenance cost	$10,950
Total annual cost (2000)	$34,050

BENEFITS

Industry considers an ample supply of good quality water a major factor influencing the location of its plants. It is attracted to areas where, in addition to other considerations, high quality water is available in sufficient volumes to meet its water supply requirements.

The value of water to industry is the measure of benefits received from its water supply. These benefits are measured by

assuming that the value of water in adequate quantity and quality is equal to the cost of obtaining water of similar quality from the most likely alternative source. In the Ogeechee Basin, ground water sources are the most likely alternative because of adequately yielding aquifers. Therefore, benefits from additional ground water sources are considered to be equal to the cost of obtaining water from ground water aquifers giving a benefit-cost ratio of unity.

SUMMARY AND CONCLUSIONS

SUMMARY

Surface waters of the Basin are used for sport fishing, wildlife, recreation, and water contact sports. Only a very small amount of surface water is used for municipal and industrial water supplies.

Ground water is plentiful throughout the Basin except in the Piedmont Province. Municipalities and industries rely upon ground water almost entirely for their needs.

Available analytical data show that the raw surface waters and ground waters of the Basin are of a quality that only a minimum of treatment is necessary to comply with the chemical characteristics of the Public Health Service's "Drinking Water Standards". Gibson and Stapleton treat ground water for the reduction of iron and hardness, and Warrenton provides sand filtration treatment for surface water. Thirteen municipalities use chlorine for disinfection and 15 other municipalities provide no treatment.

Twenty-eight communities in the Basin have municipal water supply systems. Warrenton is the only municipality that utilizes both ground and surface water. The other 27 use ground water only.

Three communities which are located in the Piedmont Province use wells 400 to 600 feet deep. Eighteen municipalities located in the Upper Coastal Plain Province use wells ranging in depth from 90 to 760 feet. The remaining seven municipal supplies are located in the Lower Coastal Plain Province and have wells ranging from 150 to 816 feet deep.

The average 1960 municipal water use is 6.02 million gallons per day.

The total 1960 population of the municipalities having water supply systems is 47,314. The average municipal water consumption is 127 gallons per capita per day. The maximum daily demand is 187 percent of the average day. Industrial water supplied by the municipalities amounts to about three percent of the total municipal use.

(10/2/61)

Six of the municipal systems have reported that improvements are needed for the existing water supply systems.

There are an estimated 21,500 domestic water supply systems in the Basin using a total of 6.4 mgd. Approximately 11 percent of the domestic supplies supply more than one family.

A small sample survey of the domestic supplies in the Basin indicates that there are 9700 dug wells, 9700 drilled, 1075 bored, and 820 driven. The number of springs used as sources of water is approximately 200.

Seven percent of the wells are inadequate to meet demands in the months of July through September. Only two-thirds of the domestic supplies meet acceptable sanitary standards for construction and/or equipment.

The total industrial water consumption in the Basin is estimated to be 0.62 mgd based on a yearly average. This includes 0.39 furnished by industrially owned sources and 0.23 mgd furnished by municipal water supply systems.

CONCLUSIONS

A study of the basic data indicates that nineteen of the communities could strengthen or improve their existing water supply systems. The total cost of the needed improvement for 1960 is estimated to be $276,000. Projected municipal water demands indicate that by 1975, 31 municipalities serving a total population of 57,700 will have a water demand of 9.07 mgd. By the year 2000, the same municipalities will have a population of 72,800 where total water demand will be 14.4 mgd. By 1975, eight municipalities will need additional wells, 13 will need more storage facilities, 6 will need to expand treatment facilities and 29 will need to extend their distribution systems. The cost of these improvements is estimated to be $1,171,000. By the year 2000, the municipalities will have grown to the extent that 10 will need additional wells, 13 will require more storage facilities, and one will need to expand its surface water intake and treatment plant. Twenty-eight will have to add to their distribution systems to supply their increased populations, and nine communities will need new disinfection facilities. The cost of these improvements is estimated to be $1,774,000. The annual cost of supplying water to municipal users is estimated to be $546,500 in 1960, $761,800 by 1975 and $1,086,100 by the year 2000.

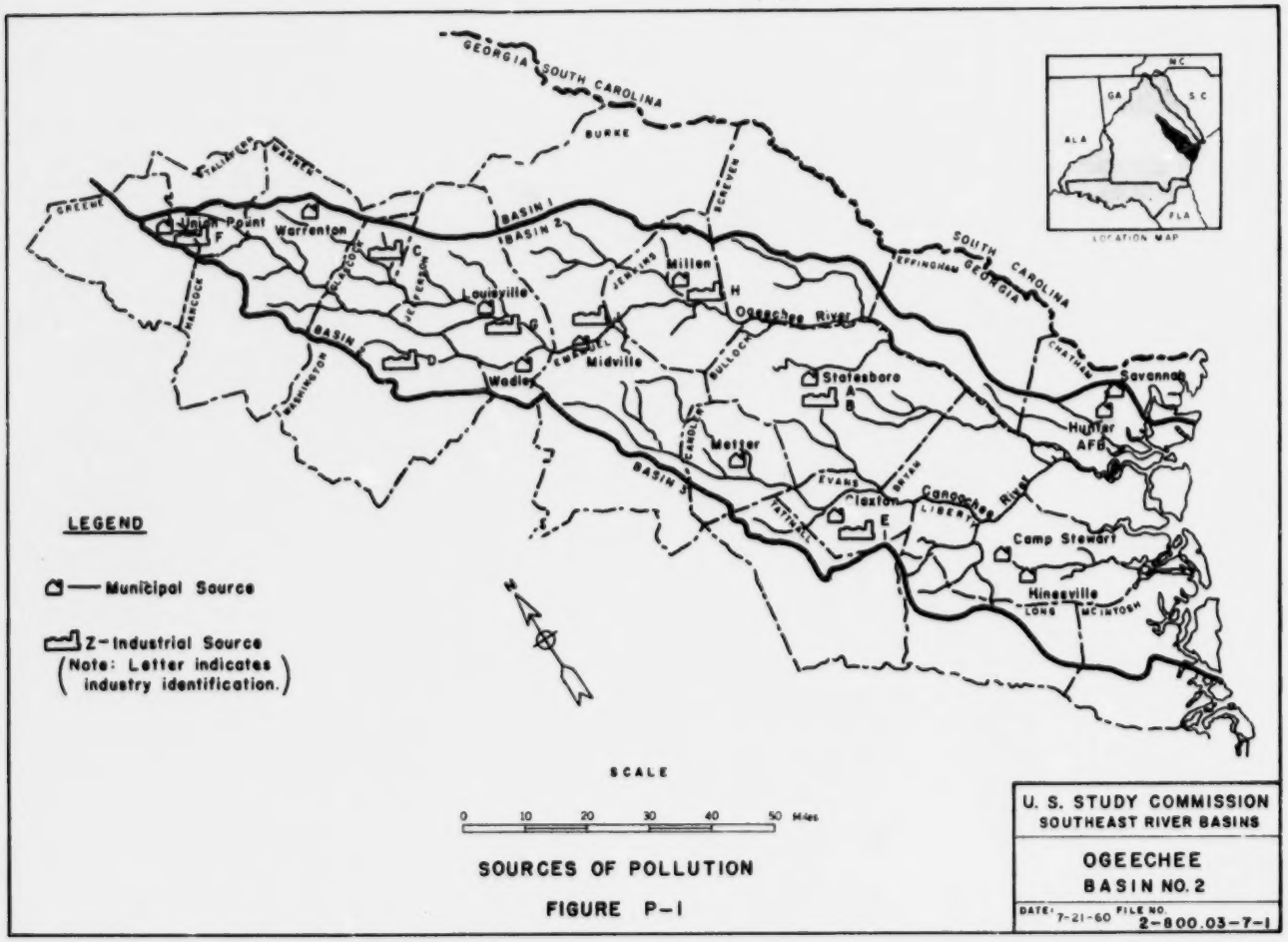
The cost of improving existing domestic water systems is estimated to be $1,880,000. The present farm and rural non-farm population not served by municipal water systems is estimated to

decrease by 35 percent and 71 percent by 1975 and 2000, respectively. The number of domestic users in 1975 will be 60,300 with a total demand of 4.2 mgd. By 2000 there will be 26,900 domestic users needing a total of 2.7 mgd. The annual cost of furnishing water to the domestic users is estimated to be $1,207,780 in 1960, $785,000 by 1975 and $350,000 by the year 2000.

Industrial water use from private sources is estimated to be 0.53 mgd and 0.68 mgd by 1975 and 2000 respectively. By 1975, one industry will need an additional well costing $12,000, but no industrial water supply facility needs are expected between 1975 and 2000. The annual cost of providing water to industrial users is estimated to be $30,940 in 1960, $32,100 by 1975, and $34,050 by 2000.

The ground water resources of the Basin are generally adequate to meet present and future demands by municipalities, industries, and domestic users. However, future demands of municipalities and industries in the Piedmont Providence may require development of additional surface water sources.

POLLUTION ABATEMENT


GEORGIA
SOUTH CAROLINA
BURKE
JEFFERSON
SCREVEN
EFFINGHAM
GEORGIA
SOUTH CAROLINA
CHATHAM
Savannah
Hunter AFB
GREENE
HANCOCK
WASHINGTON
WILKINSON
BALDWIN
TALIAFERRO
WARREN
Union Point
Warrenton
F
C
BASIN 1
BASIN 2
BASIN 3
Louisville
G
Wadley
D
Midville
EMANUEL
JOHNSON
Millen
H
Ogeechee River
BULLOCH
Statesboro
A
B
CANDLER
Metter
EVANS
BRYAN
LIBERTY
LONG
MCINTOSH
Camp Stewart
Hinesville
Pooler
E
I
LEGEND
Municipal Source
Z-Industrial Source
(Note: Letter indicates industry identification.)
N
LOCATION MAP
NC
GA
SC
ALA
FLA
SCALE
0 10 20 30 40 50 Miles
SOURCES OF POLLUTION
FIGURE P-1
U. S. STUDY COMMISSION
SOUTHEAST RIVER BASINS
OGEECHEE
BASIN NO. 2
DATE: 7-21-60
FILE NO. 2-800.03-7-1

INTRODUCTION

SCOPE OF MEMORANDUM

This memorandum contains data and information concerning the present status of municipal and industrial sewage works in the Ogeechee Basin. Although a portion of the sewage from the City of Savannah is discharged to the Ogeechee Basin, the larger portion of the sewage and all of the industrial liquid wastes are discharged to streams of the Savannah Basin. This memorandum will consider only that portion of the sewage discharged to the Ogeechee Basin. Projected future pollution abatement requirements for the years 1975 and 2000 are also presented, as are suggested solutions to present and anticipated future inadequacies. In connection with these solutions, an appraisal of the benefits to be derived from the proposed program and the annual costs of pollution abatement are included.

PROCEDURES AND INVESTIGATIONS

Existing data on pollution abatement in the Basin were obtained from reports, records, and correspondence of the Georgia Department of Public Health, U. S. Department of Agriculture, Georgia State Chamber of Commerce, the Georgia Department of Commerce, and other Federal and State agencies. Where data were found to be lacking or out dated, extensive field investigations were conducted by the Georgia Department of Public Health and data were submitted to the U. S. Public Health Service for inclusion in this memorandum. The field investigations of the Georgia Department of Public Health included visits to municipalities, small communities, industries, and institutions.

Data were obtained regarding the 13 municipal and 10 industrially owned sewage works in the Basin. These data were carefully studied to establish both the present and future pollution abatement requirements. Figure P-1 shows the location of existing sources of pollution in the Ogeechee Basin.

BASIC ASSUMPTIONS

Populations of individual municipalities have been projected using the average rate of growth which has occurred during the past 30 years. Preliminary 1960 Census figures were used for municipalities with populations over 1,000 and estimated 1960 figures were used for communities with populations under 1,000. Municipalities with populations of 1,000 or more had an average growth rate of about 1,7 percent per year and those under 1,000 grew at the rate of about 1.0 percent per year. These values were used in projecting municipal population to 1975 and 2000.

(10/2/61)

Since the Basin is an agriculture area, most of the industrial growth is expected to be made by the food processing industries. For the purpose of this memorandum, no additional industries are anticipated for the Basin; however, the existing food processing industries are expected to increase their production 20 percent by 1975 and 50 percent by 2000.

For the purpose of this memorandum, it is assumed that municipalities of 800 or more should be sewered now and municipalities of less then 800 should be sewered whenever the present methods of disposal are considered inadequate. It is also assumed that each municipality, regardless of population, now partially sewered should extend its collection system to serve the total population.

In the administration of "Grants for Construction" under Section 6 of Public Law 660, the Public Health Service has established "the substantial removal of settleable solids" as the minimum acceptable treatment for projects in which the Federal Government participates. In general, the Public Health Service considers primary treatment to be the minimum acceptable degree of treatment for municipal sewage and an equivalent treatment the minimum for industrial liquid wastes. The need for additional treatment has been determined on the basis of expected dilution water available during periods of low stream flow and/or downstream water use. Oxidation ponds have been recommended for most municipalities with less than 1500 persons.

It is assumed that primary treatment plants will effect 35 percent BOD removal and secondary plants will effect 85 percent BOD removal. Tertiary treatment or a greater than 85 percent BOD removal has not been considered for purposes of reducing low flow requirements. At these higher treatment efficiencies, dilution water requirements for water quality control depend on dilution of nutrients and chemicals present in the water rather than dilution of remaining BOD. Plant nutrients and chemicals are reduced very little if any in conventional sewage treatment plants and must therefore be considered as important pollutants in sewage effluents.

Sewage works costs have been estimated on the basis of per capita cost data developed by the Public Health Service and adjusted on the basis of the January 1, 1960 Engineering News-Record Construction Cost Index for Atlanta, Georgia. Engineering, legal, and financing costs have been added on the basis of United States experience for the period July 1956 - June 1959. Sewage system costs include the cost of structures, devices, equipment, and appurtenances intended for the collection and pumping of sewage. Treatment plant costs include the cost of treatment facilities and outfall lines.

Annual equivalent capital costs, annual operation and maintenance costs, and replacement costs of existing and needed pollution abatement

facilities were estimated on the basis of January 1, 1960 constant dollars. Interest rates of 4¼ percent were used for determining annual costs for both industries and municipalities.

GENERAL

Water pollution may be defined as the adding to water of any substance, or the changing of water's characteristics in any way which interferes with its use for legitimate purposes. Water polluting substances may be classified according to eight general categories: (1) Sewage and other oxygen demanding wastes, (2) infectious agents, (3) plant nutrients, (4) organic chemical exotica, (5) sediments, (6) radioactive substances, (7) heat, and (8) toxic and other mineral and chemical substances.

The Nation and its communities, as well as business and private operations and individuals, incur losses or damages because of water pollution. Some of these losses or damages are reflected directly in additional costs for construction, operation and maintenance of water treatment facilities. By far the larger share of the total damages is not directly accountable. The impairment to health, the loss or diminution of fishing and recreational uses, and depreciated property values, caused by polluted waters, have an adverse economic impact which is diffused throughout society. This is paid for through the reduction in utility of the water resources and the restriction on economic growth rather than through dollar payments for corrective devices. Unfortunately, these indirect consequences of pollution are not readily expressed in dollar terms because of their diffusiveness and because they are not recorded by direct, open-market transactions. Nevertheless, such adverse consequences are real and constitute a handicap to the fulfillment of economic and social goals.

Pollution control measures alleviate these adverse conditions and produce economic benefits associated with the improved waters. These benefits are often not apparent to the public, however, because they constitute insurance for future usefulness as well as for immediate purposes, or they may be indirect or intangible. The computation of these benefits faces the same difficulties as the computation of the total damages. That is, the dollar measurement problem has not yet been solved and a yardstick for actions or events not recorded in market transactions is lacking. Many of the benefits from pollution control are in this nonmarket realm, i.e., enhancement of fishing and recreational opportunity, protection of health, scenic improvement, and assurance of the future utility of water resources for various other purposes. The private market price system, therefore, cannot be relied upon solely or chiefly to provide the measurement. New devices for taking into account the social or public values must be devised.

(10/2/61)

INVENTORY OF POLLUTION ABATEMENT

SOURCES OF POLLUTION

The surface waters of the Basin are used for the final disposal of liquid wastes, treated and untreated, from 13 municipalities and 10 industrial sewage works as shown in Tables P-1 and P-2. Municipalities discharge 7.28 mgd of sewage of which 6.30 mgd has undergone primary or secondary treatment and the 10 industries discharge 0.352 mgd of liquid wastes of which 0.188 mgd has undergone screening or sedimentation.

The 13 municipalities, which include Hunter Air Force Base, Fort Stewart Army Base, and a portion of the city of Savannah, have a total 1960 population of 100,329 and collect sewage from 57,360 persons. Sewage collected from approximately 36,700 persons in the Ogeechee portion of the City of Savannah is discharged to the Savannah Basin. The total population equivalent (PE) of the sewage of the Ogeechee Basin is estimated to be 58,560 before treatment and 14,100 of this are discharged to Basin waters after treatment. The major sources of industrial liquid wastes in the Basin are eight food processing plants and a textile plant. The strength of the wastes from eight industries for which data were available is estimated to be 42,300 PE based on BOD. Not included in this total are wastes from the textile plant and inorganic plating wastes and cooling waters discharged by a metal fabrication plant.

The waters of the Basin also receive pollution from natural sources and from the agricultural use of the land. Pollution from natural sources include organic material leached from the decaying matter in the forests and swamps and minerals dissolved from the soil and rocks. The pollution resulting from the agricultural use of the land includes organic and mineral fertilizers, insecticides, pesticides, and herbicides which are washed into the waters during heavy rains or which are inadvertently deposited into the waters during application. Silt, eroded from roadsides and farm land, especially in the Piedmont Providence, is a pollutant in the extreme upper portion of the Basin. Drainage from livestock feed lots, dairy barns, pig pens, manure heaps, and other farm refuse also add to the pollution load carried by the streams.

EXISTING SEWAGE TREATMENT FACILITIES

As shown by Table P-1, five municipalities provide secondary treatment for sewage collected from 45,500 persons (or 79.5 percent of the sewered population discharging sewage to the Basin waters). These municipalities are Fort Stewart, Hinesville, Hunter Air Force Base, Statesboro, and a portion of Savannah which lies in the Ogeechee Basin. The effectiveness of the secondary treatment ranges from 85 to 94 percent based on estimated BOD reduction.

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(10/2/61)

TABLE P-1
BASIC DATA ON SOURCES OF MUNICIPAL POLLUTION
OGEECHEE BASIN

Municipality	1960 Pop.	Est. Pop. Served	Est. Ave. Flow* mgd	Type of Treat-ment	Design Cap. PE 1,000s	Design Cap. Flow mgd	Est. PE(BOD) Untr'd Waste	Est. PE(BOD) Disch'd Waste	Receiving Stream
Claxton	2,672	1,800	0.18	septic tk	--	0.140	1,800	1,800	Branch-Canoochee R.
Ft. Stewart Pt#1	4,500	4,500	--	sec.	90.0	9.000	5,000	500	Canoochee R
Pt#2			1.78	lagoon	0.5	0.050			
Hinesville	3,174	2,400	0.250	sec.	5.3	0.530	3,000	300	Canal-Peacock R-Newport R
Hunter Air F. Base	5,560	5,560	0.62	sec.	7.5	0.750	5,560	840	L. Ogeechee R
Louisville	2,413	1,500	0.10	pri.	4.0	0.400	1,600	800	Rocky Comfort Cr-Ogeechee R
Metter	2,362	2,000	0.20	septic tk	--	0.063	2,000	2,000	Kennedy Br-15 Mile Cr-Canoochee R
Midville	676	300	0.080	none	--	--	300	300	Ogeechee R
Millen	3,633	2,400	0.36	none	--	--	2,400	2,400	Buckhead Cr-Ogeechee R
Savannah (part)	61,700	25,000	2.60	sec.	25.0	2.500	25,000	1,450	Casey Canal-Vernon R
Statesboro	8,356	8,000	0.70	sec.	10.0	1.000	8,000	800	Little Lott's Cr-Canoochee R
Union Point	1,615	1,200	0.10	pri.	2.0	0.200	1,200	600	North Br-Ogeechee R
Wadley	1,898	1,500	0.16	none	--	--	1,500	1,500	Williamson Swamp Cr-Ogeechee R
Warrenton	1,770	1,200	0.15	pri.	3.0	0.300	1,200	800	Rocky Comfort Cr-Ogeechee R
Totals	100,329	57,360	7.28				58,560	14,090	

*Estimates based on water use.

(10/2/61)

TABLE P-2
BASIC DATA ON SOURCES OF INDUSTRIAL POLLUTION
OGEECHEE BASIN
(Industries not connected to municipal sewer systems)

Location by County	Code	No. of Emp.	Type of Industry	Type of Waste	Ave. Flow mgd	Treatment Provided	PE (BOD) Untr'd Waste	PE (BOD) Disch'd Waste	Discharged to
Bulloch	A	305	metal fabrication	plating	--	evap pit	--	--	
				cooling water	0.010	none	--	--	storm sewer
Bulloch	B	60	meat pk	process	0.050	irrigation	4,100	0	land
Glascock	C	65	canning	process	0.040	screens	3,360	3,360	Brassell Br-Ogeechee R
Washington	D	76	canning	process	0.035	screens	8,000	8,000	Rogers Br-Ogeechee R
Evans	E	65	poultry	process	0.085	traps	3,060	3,060	Br-Canoochee R
Greene	F	450	textile	process	0.095	none	undet	undet	Ogeechee R
Jefferson	G	2	meat pk	process	0.001	septic tk	46	35	Br-Ogeechee R
Jenkins	H	5	meat pk	process	0.008	none	360	360	Swamp-Ogeechee R
Evans	I	5	meat pk	process	0.003	lagoon	580	120	Cedar Cr-Canoochee R
Burke	J	75	canning	process	0.025	screens	22,800	22,800	
Totals		1108			0.352		42,306	37,735	

Three municipalities, Louisville, Union Point, and Warrenton provide primary treatment for sewage collected from 3,900 persons (or 6.8 percent of the sewered population discharging wastes to the basin waters). The effectiveness of the primary treatment ranges from 33 to 50 percent based on estimated BOD removal.

Claxton and Metter have septic tanks which are overloaded and consequently ineffective as treatment facilities. Millen, Midville, and Wadley provide no treatment facilities. Sewage collected from 8,000 persons in these five municipalities is discharged untreated to surface waters of the Basin.

As shown by Table P-2, seven of the industries provide little or no treatment for industrial liquid wastes. A meat packing plant in Jefferson County discharges process wastes to an overloaded septic tank. Three canning plants in Glascock, Washington, and Burke Counties provide screens to remove larger solids from process wastes. A poultry processing plant in Evans County discharges process wastes through a trap which removes most feathers and other large solids. A meat packing plant in Jenkins County and a textile plant in Green County discharge untreated process wastes to the waters of the Basin.

However, three other industries in the Basin provide more adequate treatment. A meat packing plant in Evans County discharges process wastes to a stabilization pond. A metal fabrication plant in Bulloch County discharges plating wastes to an evaporation pond and a meat packing plant disposes of its liquid wastes by broad irrigation.

All other industries in the Basin discharge liquid wastes either to septic tanks with sub-surface drain fields or to municipal sewer systems. Industries disposing of liquid wastes by these methods were not inventoried and no data are available.

Soil conservation practices are used in many areas of the Basin and are quite effective in preventing pollution resulting from agricultural use of the land. Good erosion preventive measures, practiced by the highway and railroad maintenance departments, assist in the control of sediment coming from roadway embankments. There are no pollution control measures used especially for the purpose of abating pollution from natural sources.

EFFECTS ON STREAMS

Pollution of the fresh water streams in the Basin is not widespread at the present time. Degraded water quality is generally confined to localized areas immediately downstream from municipal and industrial sewage outfalls. For example, at Claxton, municipal sewage discharged to a small branch of the Canoochee River causes considerable odor and adverse stream conditions during periods of low flow. Similar

conditions were reported at Metter, Savannah, and Warrenton. The textile plant in Greene County discharges liquid wastes to the Ogeechee River adversely affecting fish and aquatic life for about ten miles downstream. Dye wastes occasionally color the water for several miles.

A survey conducted by the Georgia Game and Fish Department during the summers of 1957 and 1958 indicated the presence of dissolved oxygen (D.O.) in all reaches of the Ogeechee and Canoochee Rivers. Samples were obtained from 11 stations. The D.O. content ranged from 3.7 to 10 ppm. The report stated that the only known pollution in the Ogeechee River was in the head waters and that the low pH and high CO_2 values obtained agree with the assumption that the low oxygen readings were due to decomposition typical of swamps and marshes rather than as a result of wastes discharges.

A more recent survey by the Public Health Service conducted during November 1960, January and February 1961, and June 1961 showed that the average D.O. at three stations on the Ogeechee River during the fall and winter exceeded 85 percent saturation. The stations on the Ogeechee River were located near Louisville, Rocky Ford, and Richmond Hill. No D.O. values were less than 5.1 ppm. The average D.O. reported at one station on the Canoochee River near Claxton ranged from 57.1 to 86.4 percent saturation with the lowest D.O. value being 4.3 ppm. The coliform concentration reported at the four stations in the Basin ranged from 43 to 9300 MPN per 100 ml. This data is from the Water Quality Basic Data report.

The tidal waters of the Basin have been adversely affected by pollution. Large areas of the tidal estuaries from Savannah to Sapelo Sound are closed to shellfish harvesting due to coliform bacteria counts exceeding 70 MPN per 100 ml.

Visual observations of the Ogeechee River and its tributaries were made by the Georgia Department of Public Health during August 1960 and are reported below:

1. North Fork, Ogeechee River at State Highway 77 Bridge, south of Union Point, above municipal sewage plant outfall. Small volume of flow. Discolored by dye.

2. North Fork, Ogeechee River, approximately 2 miles east of Crawfordville. Stream about 5 feet wide, flowing very slowly, slightly turbid, no floating solids or scum observed.

3. Ogeechee River at State Highway 22 Bridge below Crawfordville, below confluence of North and South Forks. Stream about 10 feet wide, flowing very slowly, slightly turbid, no floating solids or scum observed.

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4. Ogeechee River at State Highway 16 Bridge, east of Sparta. Some turbidity from recent rains, only light silt load, no other signs of pollution.

5. Ogeechee River at State Highway 102 Bridge, south of Mitchell. Some turbidity.

6. Ogeechee River, State Highway 24, east of Louisville. River 15 to 20 feet wide, slow flowing with considerable color and some turbidity. Above the Louisville sewage plant outfall no fishing or swimming observed at the time of visit.

7. Ogeechee River, U. S. Highway 1, south of Louisville below the Louisville treatment plant outfall and below the confluence of Rocky Comfort Creek and the Ogeechee River. River approximately 20 feet wide, slow flowing, noticeable swamp water color, some turbidity. Two boats with fishermen were observed at this point.

8. Ogeechee River, State Highway 56 at Midville. River 30 to 40 feet wide, deep and slow flowing, dark swamp color, and no turbidity. The Midville sewage outfall discharges into a deep pool 100 feet downstream from bridge. Observations at bridge and at point of discharge did not disclose any visual signs of pollution.

9. Ogeechee River at U. S. Highway 25, south of Millen. Stream 40 feet wide, slow flowing, typical swamp water color, no floating solids or scum observed. This observation point is five or six miles below the City of Millen sewage outfall. Fishermen were observed along the banks of the main stream and along some open channels in the swamp along the roadside. Turtles and small fish were observed in the water.

10. Canal at Millen near State Highway 17 Bridge and overpass. Sewage and industrial wastes from Millen are discharged to an open canal which carries the wastes to the swamp. At the time of observation, the flow in the canal was a brilliant red due to discharge of dye material.

11. Ogeechee River at U. S. Highway 301. River approximately 80 feet wide, typical color of swamp water, a slow flowing stream. Fishing camp at this point with boats for rent. Observed several people swimming and fishing from boats. No evidence of pollution observed. This observation point is approximately 30 river miles below Millen, the last point of wastes discharge to the swamp flood plain and approximately 60 miles below Midville which discharges wastes with population equivalent of 300 directly to the stream.

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12. Ogeechee River at U. S. Highway 80 Bridge. River is approximately 300 feet wide at this point, slow flowing, typical color of swamp water, appears clear but colored. Several boats were observed in the area. There was no evidence of pollution observed.

13. Ogeechee River at U. S. Highway 17 Bridge, south of Savannah, below confluence of river with Canoochee River. Stream about 750 feet wide, very slow flow, typical swamp water color, and free of turbidity. No evidences of pollution were observed. A swimming area is immediately downstream from the bridge and the immediate upstream reaches are used for boating, water skiing and fishing. A fishing camp is located near the bridge and there are facilities for picnickers. This particular area of the river is reportedly used for recreation by a large number of people.

POLLUTION ABATEMENT REQUIREMENTS FOR 1960

SEWERAGE

At the present time, 10 municipalities in the Basin serve only a part of their populations and 3 municipalities with populations of 800 or more have no sewage collection system. The 10 municipalities with existing systems should extend their collection system to serve an additional 6,260 persons and the 3 municipalities should construct new collection systems to serve 3,345 persons. The total capital outlay required as shown by Table P-3 is estimated to be $483,000.

TREATMENT FACILITIES

The degree of treatment required at each municipality has been determined on the basis of available dilution water in the streams receiving the wastes. Dilution water requirements are discussed more fully in the LOW FLOW AUGMENTATION section of this memorandum.

Existing treatment facilities at Fort Stewart, Hinesville, Hunter Air Force Base, Louisville, and that portion of Savannah in the Ogeechee Basin are adequate for present requirements. The secondary treatment plant at Statesboro is adequate for present demands. However, as shown in the section on LOW FLOW AUGMENTATION, storage for augmentation is necessary to prevent degradation of the quality of the receiving stream waters during periods of low flow.

(10/2/61)

Claxton and Metter should replace their overloaded septic tanks and construct secondary treatment plants. Secondary treatment is also required at Midville, Pembroke, and Twin City and can be provided by constructing oxidation ponds. Union Point and Warrenton should add secondary units to existing primary plants. Millen, Richmond Hill, and Wadley should construct primary treatment plants. The total capital outlay required for needed new construction and additions to sewage treatment plants is estimated to be $1,437,000 as shown by Table P-3.

TABLE P-3
MUNICIPAL POLLUTION ABATEMENT
ESTIMATED NEEDS AND COSTS* FOR 1960
OGEECHEE BASIN

Municipality	Des'd for PE(1000's)	Treatment Required	Estimated Costs in $1,000		
			Sewerage	Treatment	Total
Claxton	2.7	sec.	44	336	380
Hinesville	3.8	sec.	39	--	39
Louisville	2.5	pri.	46	--	46
Metter	.24	sec.	18	306	324
Midville	0.7	sec.	19	19	38
Millen	4.1	pri.	62	272	334
Pembroke	1.5	sec.	72	31	103
Richmond Hill	0.8	pri.	40	89	129
Statesboro	8.4	sec.	18	--	18
Twin City	1.1	sec.	55	25	80
Union Point	2.0	sec.	21	104	125
Wadley	1.9	pri.	20	158	178
Warrenton	1.8	sec.	29	97	126
Total			483	1437	1920

*Costs based on January 1960 constant dollars.

Industrial liquid wastes disposal by three of the industries surveyed is adequate at present. However, seven other industries should provide more satisfactory methods of wastes treatment and disposal. Two meat packing plants in Jefferson and Jenkins Counties could discharge process wastes to nearby municipal sewers. Treatment requirements of the remaining four food processing industries and one textile plant could be effectively satisfied by oxidation ponds or equivalent treatment. The total capital outlay required for industrial pollution abatement facilities in 1960 is estimated to be $228,000 as shown in Table P-4.

(10/2/61)

TABLE P-4
INDUSTRIAL POLLUTION ABATEMENT
ESTIMATED NEEDS AND COSTS* FOR 1960
OGEECHEE BASIN

Location by County	Code	Type	Treatment Required	Estimated Costs in $1,000 Treatment
Burke	J	cannery	sec.	98
Evans	E	poultry processing	sec.	26
Glascock	C	cannery	sec.	28
Greene	F	textile	sec.	30
Jefferson	G	meat pkg.	connect to city sewers	--
Jenkins	H	meat pkg.	connect to city sewers	--
Washington	D	cannery	sec.	46
Total				228

*Costs based on January 1960 constant dollars.

OTHER NEEDS

A need exists, in the Ogeechee Basin and other areas of the Southeast River Basins, for research and studies to determine the effect of pollution from insecticides, pesticides, and herbicides and methods for its control.

A need also exists for pollution abatement measures to alleviate pollution in the coastal waters now closed to shellfish harvesting. A comprehensive study should be made to determine the sources and extent of the problem and to determine the economic feasibility of industrial and municipal sewage treatment required to adequately abate the pollution.

FUTURE POLLUTION ABATEMENT REQUIREMENTS

PROJECTIONS

Eighteen municipalities are expected to have sewage works in 1975. The projected 1975 total population of these municipalities is 109,930. As shown by Table P-5, the total PE of the sewage will be 113,850 and the PE after treatment is estimated to be 22,690.

By the year 2000, four additional municipalities will have grown to the extent that sewage works will be required. The total population of the 22 municipalities projected for the year 2000 is 200,290. As shown by Table P-5, the total PE of the sewage will be 205,390 and the estimated PE after treatment will be 38,170.

(10/2/61)

As shown by Table P-6, industrial wastes discharged by 7 industries will have a total PE before treatment of 49,860 and 63,430 by 1975 and 2000, respectively. The wastes will have an estimated total PE after treatment of 6,730 and 8,580 by 1975 and 2000 respectively. It is assumed that all other industries in the Basin will discharge wastes to subsurface systems, evaporation ponds, or to municipal sewerage systems.

TABLE P-5
MUNICIPAL SEWAGE - 1975 AND 2000
(includes industries on city sewers)
OGEECHEE BASIN

Municipality	Treatment Recommended	1975 PE Untr'd Sewage	1975 PE Disch'd	2000 PE Untr'd Sewage	2000 PE Disch'd
Brooklet	sec.	--	--	840	--
Claxton	sec.	3350	500	4500	670
Crawfordville	sec.	920	140	1120	170
Fort Stewart	sec.	5000	750	5000	750
Gibson	sec.	--	--	800	120
Guyton	sec.	800	120	980	150
Hinesville	sec.	4600	690	6100	910
Hunter AFB	sec.	5560	840	5560	840
Louisville	pri.	3100	2000	4100	2700
Metter	sec.	3000	450	4000	600
Midville	sec.	800	120	980	150
Millen	pri.	4520	2940	5900	3820
Pembroke	sec.	1850	280	2500	380
Portal	sec.	--	--	850	130
Richmond Hill	pri.	1250	810	1700	1100
Savannah	sec.	58,100	8700	131,300	19,700
Stapleton	sec.	--	--	910	130
Statesboro	sec.	13,000	1950	17,500	2630
Twin City	sec.	1400	210	1850	280
Union Point	sec.	2000	300	2700	410
Wadley	pri.	2400	1560	3200	2080
Warrenton	sec.	2200	330	3000	450
Totals		113,850	22,690	205,390	38,170

(10/2/61)

TABLE P-6
INDUSTRIAL POLLUTION - 1975 AND 2000
OGEECHEE BASIN

County and Industry		Type of Treatment Recommended	1975 Vol. of Waste mgd	1975 PE of Untreated Waste	1975 PE Discharged	2000 Vol. of Waste mgd	2000 PE of Untreated Waste	2000 PE Discharged
Bulloch	B	broad irrigation	0.060	5,000	0	0.100	6,250	0
Burke	J	sta. pond	0.030	27,000	4,050	0.038	35,000	5,250
Evans	E	sta. pond	0.102	3,680	550	0.128	4,600	690
Evans	I	sta. pond	0.003	580	90	0.003	580	90
Glascock	C	sta. pond	0.048	4,000	600	0.060	5,000	750
Greene	F	sta. pond	0.095	undet	undet	0.095	undet	undet
Washington	D	sta. pond	0.042	9,600	1,400	0.058	12,000	1,800
Totals			0.382	49,860	6,730	0.479	63,430	8,580

SEWERAGE

Assuming that sewerage requirements for 1960 have been met, additional sewerage construction will be required in 16 municipalities by 1975. Fourteen municipalities will require extension of the sewage collection systems recommended for 1960 to serve an additional 40,175 people. Two municipalities will have grown to the extent that sewage collection systems will be required to serve 1,720 people. As shown in Table P-7, the total capital outlay required for extensions and new construction of sewerage systems is estimated to be $2,095,000 to meet 1975 needs.

By the year 2000 there will be additional need for sewerage construction in 20 municipalities. This construction will consist of extension of 16 sewage collection systems recommended for 1960 and 1975 to serve an additional 87,260 people and new construction to serve 3,400 people in four municipalities. As shown in Table P-7 the total outlay required for extension and new construction of the sewage collection systems required to meet the needs for the year 2000 is estimated to be $4,534,000.

TREATMENT FACILITIES

The degree of treatment required at each municipality has been determined on the basis of the natural low flows in the stream's receiving wastes. In those areas where low flows are not sufficient to protect water quality after secondary treatment, low flow augmentation is recommended. These areas of the Basin are discussed more fully in the LOW FLOW AUGMENTATION section of this memorandum.

The sewage treatment facilities recommended for 1960 will be adequate to meet 1975 needs in Hinesville, Louisville, and Union Point. Thirteen other municipalities, however, will need to either enlarge treatment facilities recommended for 1960 or construct new treatment facilities in order to meet 1975 needs. By 1975, Claxton, Metter, Statesboro, Warrenton, and that portion of Savannah in the Ogeechee Basin should enlarge the secondary treatment facilities that were recommended for 1960; and Miller, Richmond Hill, and Wadley should enlarge primary treatment facilities recommended for 1960. Crawfordville and Guyton should construct oxidation ponds and Midville, Pembroke, and Twin City should enlarge the oxidation ponds recommended for 1960 to meet 1975 needs. The total capital outlay required for municipal sewage treatment plant construction for 1975 is estimated to be $3,416,000 as shown by Table P-7.

Treatment facilities recommended for 1960 will be adequate to meet the 1975 needs of four industries. However, three canneries and a poultry processing plant will need additional wastes treatment facilities by 1975. The total capital outlay required for this construction is estimated to be $66,000 as shown by Table P-8.

(10/2/61)

Sewage treatment facilities recommended for 1975 will be adequate to meet treatment needs for the year 2000 in Crawfordville, Guyton, Louisville, Midville, Richmond Hill, Twin City, and Warrenton. Thirteen municipalities, however, will need to either enlarge the treatment plants recommended for 1975 or construct new treatment facilities in order to meet 2000 needs. By the year 2000, Claxton, Hinesville, Metter, Savannah, Statesboro, and Union Point should enlarge the secondary treatment plants that were recommended for 1975. Brooklet, Gibson, Portal, and Stapleton should construct oxidation ponds; and Pembroke should enlarge the pond recommended for 1975 to meet sewage treatment needs by the year 2000. The total capital outlay required for municipal sewage treatment facilities needed in 2000 is estimated to be $5,093,000 as shown by Table P-7.

Four industries in the Basin will need wastes treatment facility expansion between 1975 and 2000. The total capital outlay required for this expansion is estimated to be $94,000 as shown by Table P-8.

TABLE P-7
ESTIMATED COSTS* OF MUNICIPAL POLLUTION ABATEMENT - 1975 AND 2000
OGEECHEE BASIN

	Estimated Cost in $1000					
	1975			2000		
Municipality	Sewers	Treatment	Total	Sewers	Treatment	Total
Brooklet	--	--	--	42	21	63
Claxton	34	127	161	58	174	232
Crawfordville	46	25	71	10	--	10
Fort Stewart	--	--	--	--	--	--
Gibson	--	--	--	40	20	60
Guyton	40	23	63	9	--	9
Hinesville	41	--	41	75	140	215
Hunter AFB	--	--	--	--	--	--
Louisville	29	--	29	50	--	50
Metter	32	115	147	50	166	216
Midville	10	12	22	9	--	9
Millen	9	62	71	50	127	177
Pembroke	20	13	33	33	18	51
Portal	--	--	--	42	21	63
Richmond Hill	23	97	120	22	--	22
Savannah	1655	2418	4073	3660	3600	7260
Stapleton	--	--	--	46	22	68
Statesboro	75	367	442	200	575	775
Twin City	15	20	35	23	--	23
Union Point	19	--	19	35	120	155
Wadley	25	67	92	40	89	129
Warrenton	22	70	92	40	--	40
Totals	2095	3416	5511	4534	5093	9627

*January 1960 constant dollars.

(10/2/61)

TABLE P-8
ESTIMATED COSTS* OF INDUSTRIAL POLLUTION ABATEMENT - 1975 AND 2000
OGEECHEE BASIN

Location by County	Industry Code	Industry Type	Treatment Recommended	Estimated Cost in $1,000 1975	2000
Burke	J	cannery	sec.	32	48
Evans	E	poultry processing	sec.	9	12
Glascock	C	cannery	sec.	8	12
Washington	D	cannery	sec.	17	22
Total				66	94

*January 1960 constant dollars.

LOW FLOW AUGMENTATION

GENERAL

A minimum standard of water quality for fish and aquatic life is a dissolved oxygen content of not less than 4 ppm. In determining the volume of stream flow and storage required to maintain this standard, the following assumptions were used:

1. Summer water temperatures.
2. Minimum flows are 7 day low flows occuring once in 10 years.
3. Physical characteristics and reaeration constant of streams vary as to location, size, etc. of stream.

Minimum stream flows required at locations in the Basin where liquid wastes are discharged were calculated on the basis of the estimated PE for the years 1960, 1975, and 2000. At least primary treatment was assumed for all locations, and if the required dilution flow exceeded the actual low flow, secondary treatment was recommended. The minimum flows are shown in Table P-9. Locations requiring minimum flows of less than 1.0 cfs by the year 2000 are not included in the Table P-9.

(10/2/61)

TABLE P-9
MINIMUM FLOW REQUIREMENTS
OCMULGEE BASIN

General Location	Receiving Stream	Water Required (cfs) 1960	1975	2000
GEORGIA				
Claxton	Branch - Canoochee R.	1.4	2.5	3.2
Fort Stewart	Canoochee R.	1.5	1.5	1.5
Gibson	Branch - Ogeechee R. - Rocky Comfort Cr.	1.0	1.2	1.8
Hinesville	Peacock R-Newport R.	0.9	2.5	3.0
Hunter AFB[1]	L. Ogeechee R.	1.7	1.7	1.7
Louisville[2]	Rocky Comfort Cr - Ogeechee R	2.4	4.5	6.0
Metter	Br - 15 Mile Cr - Canochee R	0.8	0.9	1.2
Midville	Ogeechee R	6.7	8.4	10.8
Millen[2]	Buckhead Cr - Ogeechee R	6.1	8.9	12.3
Richmond Hill[2]	Ogeechee R	0.0	1.8	2.6
Savannah[1]	Casey Canal - Vernon R	95.	220.	500.
Statesboro	Little Lotts Cr - Canoochee R.	2.4	3.9	5.3
Swainsboro[3]	Canoochee Cr - Canoochee R	--	2.2	2.5
Sylvania[4]	Ogeechee Cr - Ogeehcee R	--	1.4	2.5
Union Point	N. Branch - Ogeechee R	0.5	0.6	1.0
Wadley[2]	Williamson Swamp Cr - Ogeechee R	2.2	3.6	4.7
Warrenton	Rocky Comfort Creek - Ogeechee R	0.4	0.7	1.0

1. Discharge to tidewater
2. Primary treatment only
3. Wastes discharged to Altamaha Basin in 1960
4. Wastes discharged to Savannah Basin in 1960

(10/2/61)

AREAS WHERE AUGMENTATION IS NOT NEEDED

There are adequate volumes of water available, and no storage for low flow augmentation will be required to maintain desirable water quality in streams receiving waters from the following areas: Fort Stewart army base, Gibson, Hinesville, Louisville, Midville, Millen, Richmond Hill, and Wadley. Swainsboro (in the Altamaha Basin) and Sylvania (in the Savannah Basin) do not now discharge wastes to the Ogeechee Basin. In the future, however, it is expected that both cities will discharge all or part of their wastes to the Ogeechee Basin where adequate dilution water is available.

AREAS WHERE AUGMENTATION IS NEEDED

In three areas the streams carrying liquid wastes travel a few miles (1 to 5) before reaching a larger stream with adequate flow. This results in severely polluted stream conditions for a short distance during periods of low flow below Claxton, Metter and Warrenton. Storage for low flow augmentation is not economically feasible to maintain desirable water quality in the short stream distances involved.

Wastes discharges at other areas present greater problems, however, and are discussed below:

Tidewater Areas

Hunter Air Force Base and Savannah discharge wastes after secondary treatment to tidewater. Release of water from upstream storage reservoirs is seldom the solution for preventing localized pollution of tidewaters. Other corrective measures such as better dispersion of the wastes by properly designed outfalls, controlled discharge to take full advantage of tidal movement, etc., are generally the best solution to these problems. Each case requires a separate study. Therefore, tide water areas have not been considered at this time and it is recommended that further study be given these areas when the comprehensive program is developed.

Statesboro Area

Liquid wastes from Statesboro are discharged after secondary treatment into the headwaters of Little Lotts Creek where there is little if any natural flow during dry periods. There is no possibility of providing storage on Little Lotts Creek above the point of discharge. The Canoochee River at its confluence with Little Lotts Creek has ample flow to handle the partially stabilized wastes that will reach it from Statesboro. Water quality in Little Lotts Creek will be damaged to some extent for about 20 miles during periods of low flow.

(10/2/61)

If found to be desirable, protection of the quality of water in Little Lotts Creek during low flow is possible with diversion of water from storage on nearby Mill Creek. Mill Creek has a drainage area of about 39 square miles above Statesboro and storage of 1,100 acre-feet would supply the 5.3 cfs needed by 2000. The low flow augmentation requirement requirements can be met with a reservoir storage of 625 acre-feet in 1975 and 240 acre-feet in 1960.

Union Point

Liquid wastes from Union Point after secondary treatment are discharged to the headwaters of the Ogeechee River at a point where there is no flow during dry periods. As a result, the Ogeechee River will be severely polluted by the year 2000 for several miles until sufficient flow for dilution is available. Storage for low flow augmentation is not feasible on the Ogeechee River or on the adjacent streams at Union Point.

Summary of Reservoir Needs

The areas in the Ogeechee Basin where storage for low flow augmentation are needed are shown in Table P-10.

TABLE P-10
RESERVOIR STORAGE NEEDS
OGEECHEE BASIN

Location	Storage Area in Acre-Feet		
	1960	1975	2000
Claxton	Not economically feasible		
Metter	Not economically feasible		
Statesboro	240	625	1100
Union Point	No drainage area		
Warrenton	Not economically feasible		

(10/2/61)

ANNUAL COSTS AND BENEFITS

FINANCING

Municipalities can finance sewage works construction by general obligation bonds, revenue bonds, special assessments, or some combination of these methods. The Georgia law permits the issuance of general obligation bonds, to be repaid within 30 years, up to a maximum amount of 7 percent of the evaluation of taxable property within the political subdivision. The law permits an increase of this bonded indebtedness of 3 percent of the evaluation of the taxable property provided the increased indebtedness shall be repaid within a 5-year period and is approved by the General Assembly.

Georgia law authorizes the state to make grants to any county or municipality if funds are available to assist in pollution abatement projects that qualify for Federal aid under Public Law 660. The state grants are limited to 30 percent of that portion of the construction costs which qualify under the Federal aid program of $250,000, whichever is smaller. To date, however, no grants have been made by the state.

Financial aid is available to municipalities in the form of Federal grant assistance under Public Law 660. The Federal Government will pay up to 30 percent of the estimated reasonable cost of construction of municipal sewage treatment works or $600,000, whichever is the smaller. Eligible for assistance are construction of new treatment works, improvements to existing treatment facilities, intercepting sewers, outfall sewers, pumping , and such preliminary planning necessary for construction. Statesboro is the only municipality in the Ogeechee Basin that has participated in the Federal aid program to date.

Industries will undoubtedly finance their pollution abatement facilities with private capital by the most economical method available to them at the time of construction.

OPERATING REVENUE

Operating revenue for pollution abatement is generally derived from sewer charges to individual customers. Two smaller municipalities in the Basin levy a flat rate of 50 cents per month. Savannah levies a $2.50 charge per month and Statesboro levies a charge equal to 50 percent of the water bill. Three other municipalities in the Basin have no sewer charge. Where revenue from sewer charges is inadequate, expenses are met by allocation of funds from the general fund or from the water system revenue.

(10/2/61)

ANNUAL COSTS FOR 1960

The annual cost of pollution abatement by municipalities and industries in the Basin in 1960 is estimated to be $692,620. This includes the annual equivalent capital cost of existing facilities in 1960, annual replacement, and operation and maintenance cost of existing facilities. A breakdown of the total annual cost is shown below:

	Mun.	Ind.
Annual equivalent capital cost	$499,500	$ 920
Annual replacement cost	1,400	150
Annual operation and maintenance cost	188,750	1,900
Total annual cost (1960)	$689,650	$2,970

The total capital outlay required to improve existing pollution abatement facilities to meet the 1960 needs is estimated to be $1,920,000 for 13 municipalities and $228,000 for five industries. These costs are shown in Table P-3 and P-4.

ANNUAL COSTS BY 1975

The total capital outlay required for additional pollution abatement facilities needed by 1975, after 1960 needs have been met, is estimated to be $5,511,000 for 16 municipalities and $66.000 for four industries. These costs are shown by Tables P-7 and P-8.

The annual cost of pollution abatement by municipalities and industries by 1975 is estimated to be $1,116,180. This includes the annual equivalent capital cost of (1) existing facilities in 1960, (2) facilities recommended to meet 1960 needs, and (3) facilities recommended to meet 1975 needs. The replacement cost is based on the total investment by 1975 and the operation and maintenance cost is based on existing and recommended facilities for 1960 and 1975. A breakdown of total annual costs is shown below:

	Mun.	Ind.
Annual equivalent capital cost	$ 859,650	$15,200
Annual replacement cost	00	150
Annual operation and maintenance cost	234,280	6,900
Total annual cost (1975)	$1,093,930	$22,250

ANNUAL COSTS BY 2000

The total capital outlay required for additional pollution abatement facilities needed by the year 2000 is estimated to be $9,627,000 for 20 municipalities and $94,000 for 4 industries. These costs are shown by Table P-7 and P-8.

(10/2/61)

The annual cost of pollution abatement by municipalities and industries by 2000 is estimated to be $1,757,650. This includes the equivalent capital cost, the replacement cost, and the operation and maintenance cost of existing facilities and all recommended improvements for 1960, 1975, and 2000. A breakdown of total annual costs is shown below:

	Mun.	Ind.
Annual equivalent capital cost	$1,327,150	$19,750
Annual replacement cost	00	150
Annual operation and maintenance cost	402,800	7,800
Total annual cost (2000)	$1,729,950	$27,700

BENEFITS

It is recognized that pollution control results in benefits to public health and to those economic activities associated with the use of water of improved quality. However, because there is no established market value for water, as a commodity sold in a competitive market, monetary benefits from improvement in quality of water now used or anticipated to be used in the future, publicly or privately, in the Ogeechee Basin are indeterminate. While pollution abatement does enhance fishing and recreational opportunities, protect health, preserve and improve property and aesthetic values, and assure future utility of water resources, these values are confined largely to the intangible or social realm.

Ordinarily for those functions for which no market values are clearly established their values may in some cases be derived or estimated indirectly from prices established in the market for similar or analagous effects or may be derived from the most economical cost of producing similar effects by an alternative means. In the case of pollution abatement, however, there are no established prices for similar effects since no analagous effect exists. Neither are there alternative means of providing similar effects since, in most cases, the most likely, least cost means of attaining the desired effects is used. Therefore, lacking adequate methodology for assessing social values, benefits from pollution abatement must, for the time being, be considered as intangible. In the absence of established or synthetic market values, since the benefits from pollution abatement are real although intangible, it is considered that benefits accruing from pollution control by conventional treatment processes are at least equal to the cost of providing the facilities.

Since knowledge of society's future needs is less complete and accurate than information of present requirements, there could well be a tendency to adopt a water quality standard that is at times too high. Such has not been the case in the development of costs in this memorandum, however, because only minimum requirements or needs have been expanded into the future.

(10/2/61)

SUMMARY AND CONCLUSIONS

SUMMARY

Data were obtained regarding 13 municipal and 10 industrially owned sewerage works in the Basin. The 13 municipalities discharge 7.28 mgd of sewage of which 6.30 mgd has undergone primary or secondary treatment. The 10 industries discharge 0.352 mgd of liquid wastes of which 0.188 mgd has undergone treatment to some degree. All other industries in the Basin discharge liquid wastes either to subsurface systems, evaporation ponds, or to municipal sewers.

The waters of the Basin also receive pollution from natural sources and from the agricultural use of the land.

Sewage is collected from 57,360 persons although the total 1960 population of municipalities discharging sewage is 100,329. The wastes discharged have an estimated total PE of 58,560 before treatment and 14,100 after treatment. Sewage collected from approximately 36,700 persons in the portion of the City of Savannah in the Ogeechee Basin discharged to the Savannah Basin.

Five municipalities provide secondary treatment for sewage from 45,500 persons. The effectiveness of treatment, based on estimated BOD reduction, ranges from 85 to 94 percent. Three municipalities provide primary treatment for sewage collected from 3,900 persons. The effectiveness of this treatment ranges from 33 to 50 percent BOD reduction. Two municipalities have septic tanks which are overloaded and consequently are ineffective as treatment facilities. Three municipalities provide no treatment and discharge untreated sewage collected from 8,000 persons.

The strength of the liquid wastes from the industries for which data were available is estimated to be 42,306 PE based on BOD. These wastes are discharged from 8 food processing plants, a textile mill, and a metal fabrication plant.

Three of the industries provide adequate treatment of liquid wastes. The remaining seven provide screening or sedimentation which removes only the larger solids.

Pollution of fresh water streams is not widespread but is generally confined to localized areas immediately downstream from municipal and industrial wastes outfalls. Surveys conducted by the Public Health Service in the Basin indicate the average dissolved oxygen content at four sampling stations on the Ogeechee and Canoochee Rivers is greater than 4 ppm.

The tidal waters of the Basin have been adversely affected by pollution. Large areas of the tidal estuaries have been closed to shell fish harvesting due to high coliform bacteria counts.

(10/2/61)

CONCLUSIONS

A study of the basic data indicates that 10 municipalities should extend their collection systems to serve an additional 6,260 persons in 1960. Three other municipalities should construct new collection systems to serve 3,345 persons. Ten municipalities should construct new sewage treatment facilities or enlarge existing treatment facilities. The total capital required to meet 1960 municipal sewerage and sewage treatment needs is estimated to be $1,920,000.

Five industries should construct more adequate waste treatment facilities and two should connect to municipal sewer systems. The total capital required to meet 1960 needs is estimated to be $228,000.

The projected 1975 population of the 18 municipalities expected to have sewage works is 109,930. In addition to 1960 sewerage requirements, there will be a need for sewerage construction in 16 municipalities to serve an additional 41,895 persons. Treatment facilities or enlargements of existing facilities will be needed by 13 municipalities by 1975. The total capital outlay required for municipal sewerage and sewage treatment construction is estimated to be $5,511,000. Treatment facilities recommended for 1960 will be adequate for all but four industries by 1975. The capital outlay required for treatment facility enlargements for four industries is estimated to be $66,000.

The projected population by the year 2000 of 22 municipalities expected to have sewerage and sewage treatment is 200,290. Assuming that 1975 needs will have been met, there will be an additional need of sewerage construction in 20 municipalities to serve 90,660 persons. Treatment facilities or enlargements of existing facilities will be needed by 13 municipalities. The total capital outlay required for municipal sewage works construction by the year 2000 is estimated to be $9,627,000. Four industries will need to enlarge their waste treatment facilities. The capital outlay required by industries by 2000 is estimated to be $94,000.

There are several streams in the Ogeechee Basin with insufficient water during periods of low flow to dilute water after secondary treatment to a point where degradation of water quality will not occur.

At Claxton, Metter, and Warrenton the wastes travel a few miles (1 to 5) before reaching a larger stream with adequate flow. Augmentation needed for this short distance is not economically feasible. Augmentation is needed at Union Point but the drainage area above the point of discharge is insufficient to provide the needed runoff. At Statesboro, storage for augmentation can be provided Mill Creek and diverted to Little Lotts Creek when needed. The storage required is 240 acre-feet, 625 acre-feet and 1,100 acre-feet in 1960, 1975, and 2000 respectively.

(10/2/61)

Pollution effects from Savannah and Hunter Air Force Base in Tidewater Areas could not be fully evaluated. Additional and more detailed study is necessary for comprehensive planning in this portion of the Basin.

The annual cost of adequate pollution abatement in the Ogeechee Basin is estimated to be $692,620, $1,116,180, and $1,757,650 in 1960, 1975, and 2000 respecitvely.

PUBLIC HEALTH

INTRODUCTION

This Technical Memorandum is written with the limitation that field data were not available for all phases. Presentation of data in the subject areas of Vector Control and Solid Wastes is based upon published material and on field studies done by the Communicable Disease Center of the Public Health Service. The information is general and portions cannot be applied specifically to the Basin, but their presentation will serve as a guide to the solution of Basin problems as well as broader State and Regional problems.

VECTOR CONTROL

INTRODUCTION

Vector problems and control efforts in the Basin may be subdivided into two segments - urban and rural. In thus study, selected towns in the Basin over 1,000 population were studied and grouped into what is called the urban setting. Most towns which have vector control programs are primarily concerned with the control of mosquitoes and secondarily, with flies, rats, and other vectors. In the rural areas, vector problems (except with 5- to 10-mile range fresh-water flood mosquitoes) are mostly associated with the activities of the individual farmer who solves them on an individual basis. Exceptions to the latter occur in the mosquito control work in Chatham County, Georgia, and countywide rodent control programs in Bulloch and Emanuel Counties.

For long-range planning concerning land and water uses, emphasis has been given to recommendations that would result in an environmental state by the years 1975 and 2000 requiring only a minimum of repetitive pesticide application. This will not only minimize the cost of vector control programs to the public,but will make them more effective.

The economic development of the immediate coastal areas in this Basin appears to be slowed by large private estates and lack of public highways to coastal islands.

EXISTING VECTOR PROBLEMS

Eastern encephalitis ("sleeping sickness") has caused losses among horses in the Basin. Relatively high rates of infection of this disease were reported from Long, McIntosh, and Tattnall Counties during the period 1955-57. Mosquito vectors of this highly fatal human and horse disease are most prevalent in the swamps and marshes located close to and along the coast.

Primary locally transmitted malaria has not been reported in Georgia in recent years. The number of malaria mosquitoes, Anopheles quadrimaculatus, remains about the same in the Basin as in malaria transmission days. Therefore, as long as travelers are bringing malaria parasites back to this country from malarious areas of the earth, there will remain a danger of malaria transmission. Thus, the continuance of mosquito control efforts coupled with surveillance will still be required for many years. Fresh-water pools and ponds with vegetation are favorite breeding places for malaria mosquitoes.

Typhus fever (flea-borne) was a severe problem in Georgia during the 1930's and 1940's. During recent years improved sanitation practices (limiting the domestic rat's food and harborage) and the use of newer

rat poisons and flea insecticides have reduced transmission of this disease to low levels. In 1959, only eight cases of typhus were reported in Georgia. The pest control industry has played an important role in halting typhus transmission in the urban setting. Most of the remaining transmission of this disease takes place in rural areas.

Rocky Mountain spotted fever occurs occasionally in Georgia. An average of 23 cases per year was reported in the State during the period 1955-59. Increased use and number of recreational areas and construction of outlying suburban housing areas appear to increase the possibility of American dog ticks transmitting Rocky Mountain Spotted fever to humans. It is noteworthy that in Eastern United States the incidence of this disease has been highest among vacationists and picnickers, particularly among women and children.

General vector problems will be discussed with reference to those due to natural causes and those due to man's activities.

The coastal area of the Ogeechee Basin with its extensive tidal marshlands is notorious for biting insect problems. In this area, salt-marsh mosquitoes, sand flies, horse flies, and deer flies occur in large numbers and cause great annoyance to the residents and visitors to recreational areas. The salt-marsh mosquitoes are the most formidable pests of the group. At times these mosquitoes occur in such overwhelming numbers that outdoor activities during the day or night are practically impossible. Large broods of salt-marsh mosquitoes frequently occur following unusually high tides or heavy rains. It is estimated that each coastal county has about 10,000 acres of mosquito breeding salt-marsh land.

Fresh-water swamps, marshes, and low-lying areas that receive floodwater are also important sources of mosquitoes. Each coastal county is estimated to have about 5,000 acres of fresh-water flood mosquito breeding land.

In the lower portion of the Basin, numerous patches of alligatorweed and water hyacinths are found in ponds, ditches, and drainage creeks. Both of these noxious weeds were introduced from tropical areas and are spreading. Profuse growths of these weeds tend to clog drainage ditches, canals, ponds, etc., creating conditions favorable for propagation of malaria mosquitoes.

Vector problems due to man's activities include those in urban areas and those in rural areas.

In urban areas, vector problems are frequently associated with improper disposal of sewage wastes. Severe Culex mosquito problems have developed in many towns in the Basin because of the discharge of raw or inadequately treated sewage into stagnant drainage canals. Where such canals discharge into swamps, the situation is even worse. Extremely heavy breeding of Culex quinquefasciatus have occurred in such a habitat near Statesboro before a new sewage treatment plant went into operation. In about 25 percent of the towns studied, overflowing septic tanks, which left ideal places for the breeding of mosquitoes, were a problem. Sewage stabilization ponds are beginning to appear in the Basin and could cause mosquito breeding problems unless they are properly maintained. There are two sewage stabilization ponds in Chatham County successfully handling sewage from outlying subdivisions.

A severe housefly problem has occurred the past two summers in a large suburban area near Savannah's over-loaded Bacon Park sewage treatment plant. Housefly breeding of great magnitude has occurred in the drying beds dosed with undigested sludge.

About 30 percent of the homes in the urban areas do not meet minimum sanitation standards and thus have many associated fly, rat, and mosquito problems. The city of Savannah has a minimum housing program centered in the Health Department. Approximately 10 percent of the estimated 13,000 substandard housing units have been brought up to standard in three years of program operation. An additional 279 housing units were razed and 18 vacated.

Fly and rat vector problems in several of the towns are caused by inadequate storage and disposal of refuse and the keeping of farm animals in towns. Most towns have open dumps for refuse disposal. About 75 percent of the towns studied still have large numbers of animals and poultry.

The breeding of Culex mosquitoes in catch basins in several towns was noted. A large epidemic of St. Louis encephalitis was caused in Louisville, Ky. essentially by Culex mosquitoes breeding in catch basins.

The utilization and management of water in rural areas may give rise to a variety of insect vector problems.

Inadequacies of general drainage construction and maintenance are quite conducive to mosquito breeding in this Basin. This is especially true where suburban housing subdivisions are intermingled with farming land. Many small creeks, canals, and drainage ditches

receive little or no maintenance. Some of the counties have a dragline and Chatham County has 4 draglines and about 70 prisoners for drainage work. Chatham County makes very effective use of prisoners on general drainage activities. Generally, these drainage forces are kept constantly busy with acute immediate problems and have little time to spend on planning and constructing a master-planned county-wide drainage system. Frequently, individual farmers and towns cannot construct small drainage ditches because of the lack of or clogging of large drainage canals which are the responsibility of county governments.

Mosquito breeding in farm ponds in this Basin has not been serious due to present construction and operating procedures.

Irrigation (sprinkler type) is increasing. It is used principally during periods of dry weather for such crops as tobacco and corn and for pastures. No significant mosquoto problems have developed from application of irrigation water to fields. At one time extensive acreages of rice were irrigated in the coastal section, and today the abandoned rice fields produce both salt-marsh and fresh-water flood mosquitoes. Such lands are used principally for cattle pasture.

Coastal artesian wells originating in the limestone aquifer produce an alkaline water that is very favorable for the production of malaria mosquitoes. A recent study indicated that there were 28 unused wells in Liberty County, 16 in McIntosh, and 2 in Long County.

Dredge spoil activities by the U. S. Army Corps of Engineers have created a considerable salt-marsh mosquito breeding problem along the Savannah, Ga. and Charleston, S. C. portions of the Atlantic Coast. In places, a great portion of the material dredged from the bottom of the intracoastal water and associated harbor navigation channels is a clayish muck in which large cracks form when the material dries. These large cracks form an ideal mosquito breeding place, especially for the severe biting salt-marsh mosquito, Aedes sollicitans.

A number of ditches in the Basin were constructed with continuous spoil banks on both sides. This method of spoil placement results frequently in mosquito breeding because of the lateral blockage of surface water.

Vector problems associated with land resource activities include those related to the production of livestock and poultry.

Hog parlors are beginning to spring up all over the Southeastern States and a few have appeared in this Basin. A common practice is to wash waste accumulations from the concrete floors of

the parlors to an open septic tank. This method of disposal frequently causes heavy housefly breeding. Only a small fly problem was observed in a hog parlor near Waynesboro, where the wastes material was discharged into a stabilization pond.

Chicken "factories" are also developing throughout the Southeast and are beginning to appear in this Basin. In these egg factories, the birds are usually kept in small elevated cages, beneath which cones of manure accumulate on dirt floors. In cases where the manure is kept moist due to poor drainage or the mismanagement of drinking water, major fly problems frequently develop. In another type of chicken "factory", the chickens are kept on a deep bed of wood shavings which is removed only once in 1 or 2 years. Waste chicken feed from a power conveyor plus the accumulation of manure creates a favorable breeding place for flies and rats.

Solid waste material (principally manure) on farms is being generated at increased rates and there is no easy solution for sanitary disposal without creating fly problems. The spreading of such wastes on fields at frequent intervals is frequently very difficult due to crop growing requirements.

Dairy barn liquid wastes when allowed to discharge into nearby pastures sometimes give rise to mosquito problems.

Rodent problems appear to be increasing in many of the rural areas where there are deficiencies in environmental sanitation and where there are no organized countywide control programs.

STATUS OF EXISTING PROGRAMS

There is no statewide enabling legislation for mosquito or other vector control districts in Georgia. The Chatham County Mosquito Control District was established through a "local" constitutional amendment ratified by the voters on November 6, 1958 (passed by about 10,000 to 2,000 votes). A 1-mill tax set by the County Commission for this work allows for a budget of about $140,000 per year.

The State of Georgia has specific health regulations pertaining to the impounding water. Permits are issued for the construction of farm ponds built under State Board of Health regulations.

Supportive services for vector control operations include:

1. Surveillance - Health agencies are concerned with a continuing analysis of vector problems to guide the efforts of other activities.

2. Research - Research on vector control is being carried on at a Federal station in the area -- the Technical

Development Laboratories of the Communicable Disease Center (USPHS), Savannah, Georgia.

3. Technical assistance - Health agencies provide technical assistance to the construction and operating agencies in planning and carrying out vector control operations. Local sanitarians give technical advice and assistance to local communities and to individuals.

Present vector control programs in the Basin consist of one mosquito control district, two military base programs, and several municipal mosquito control programs. The Chatham County Commission owns and operates three draglines, six fogging trucks, one airplane, and four larviciding vehicles in the Ogeechee and Savannah River Basins. The draglines and a crew of prisoners construct and maintain water management ditches. So far, water management ditches have been constructed in 1,800 acres of salt marsh and it is estimated that 5,000 acres of salt-marsh breeding area remain to be ditched. Only about 100 acres of fresh-water mosquito area have been ditched and it is estimated that 3,000 acres should be ditched (mostly pasture land). Pasture drainage ditches will not be very satisfactory until the main county canal system is expanded and improved. This latter type of canal construction at present appears beyond the financial resources of the Mosquito Commission.

Salt-marsh ditches are for the management of water in the upper portions of the marshes. Present knowledge indicates that the construction of upland water management ditches enhances fish propagation and has little or no deleterious effect on duck hunting. This ditching is usually a minimum of 8 to 9 feet and at least 2 feet deeper than mean low water. Such ditches abound in minnows and other small fish. Since small motor boats can be operated in the ditches, duck hunters like having easier access to suitable duck shooting locations. Care is taken not to drain large permanent bodies of water in the marshes which encourage duck populations and which do not breed salt-marsh mosquitoes or sand flies.

The Chatham County Commission will construct impoundments if favorable locations are found as the use of impoundments is the one permanent mosquito control method that reduces both sand fly breeding and mosquito breeding. Mosquito control impoundments favor the maintenance of larger duck populations in the area. The commission is considering introducing concrete into 3,200 mosquito breeding catch basins in Savannah.

The Chatham County Mosquito Control Commission has pioneered the routine use of the new paris green pellet formulation in the control of mosquito larvae using both aerial and ground applications. Paris green pellets are very specific in their killing effect; control of mosquitoes is excellent, and no toxic effect on crops, fish, wildlife, cattle, etc. has been noted. Paris green pellets are used

extensively and routinely at Fort Pulaski National Monument where trained naturalists have observed no side toxic effects.

Fort Stewart is a large Army post covering about 45 square miles. Mosquito problems are caused by large swamps and flatlands near the building areas. Mosquito control measures consist of drainage, larviciding, and adulticiding and costs about $50,000 per year. Equipment includes two fogging trucks, two larviciding trucks, two inspection vehicles, and insecticide mixers. The construction of large canals to ocean or tide outlets would help the problem considerably. Fort Stewart pioneered in the construction of a sewage stabilization pond in 1953 to serve a trailer court in an outlying area. This pond has been successfully operated ever since, free of odors and mosquito breeding. Fort Stewart also has an excellent sanitary landfill using the dragline excavated trench and bulldozer filling method.

Hunter Air Force Base reports diminished mosquito annoyance since the Chatham County Mosquito Control Commission started operations in 1957. The mosquito control program at the military base consists of one to four men operating two fog trucks and one mist larviciding truck. Annual expenditures are about $15,000.

Hunter Air Force Base personnel have had considerable experience with heart-worm in dogs. This is a problem throughout the coastal area of the Southeastern River Basin. Based on Hunter's figures 60 percent of all dogs have heart-worm during their lives. Heart-worm is probably transmitted by mosquitoes although fleas, ticks, or other arthropods may be involved also. Hunter has screened the guard dog kennels as a control measure. Preliminary evaluation indicates that screening helps but does not halt transmission.

Several towns in the Basin have small programs for the control of mosquitoes and other vectors (see Table PH1). These programs need more adequate financing, more permanent control measures, and better technical supervision.

There are two countywide rodent control programs administered by health departments and several of the county health departments provide free rat poison upon request together with technical advice and assistance.

EXISTING NEEDS

Legislative and regulatory needs include:

1. State enabling legislation permitting the establishment of tax-supported vector control districts in any county of Georgia. Such legislation would require an amendment to the Constitution of the State of Georgia.

2. Regulations to require the control of wasteful flow from abandoned artesian wells.

(10/2/61)

Needs pertaining to surveillance and technical assistance include:

1. More extensive surveys of vector disease occurrence and vector problems.

2. Increased training of local health department personnel in vector control intelligence.

3. Expansion of entomologic and engineering consultative services to agencies, industries, and individuals concerned with water and related land resource development.

Some of the major research needs include:

1. Development of better permanent control techniques in salt marshes that will control mosquitoes, sand flies, eye gnats and other vectors and at the same time be helpful to other interests, such as wildlife conservation.

2. Development of better equipment and methods for constructing and maintaining water management ditches.

3. Discovery of new agricultural and industrial uses for idle coastal land.

4. Improved methods for handling manure and other wastes on livestock and poultry farms.

5. Development of new chemicals to overcome insecticide resistance problems.

6. Development of improved equipment and application techniques for chemical control of vectors in urban areas.

7. Development of better chemicals for the control of alligatorweed.

8. Development of effective techniques for the control of eye gnats.

9. Improved design of catch basins so that they will not hold water.

Other program needs include:

1. Establishment of mosquito control districts in McIntosh, Liberty, and Bryan Counties. Such a system of contiguous mosquito control districts will be needed to efficiently and economically control salt-marsh mosquitoes and other vectors in the coastal salt-marsh areas. Each district would need from two to three draglines for permanent control work.

(10/2/61)

2. Development of master-planned countywide water management systems. A major inadequacy of present drainage works is the lack of coordination between county governments, towns, and individual farmers. Another inadequacy is the general lack of maintenance measures.

3. Modification of existing catch basins so that they do not hold water.

4. Increased use of sanitary landfills both in towns and in counties. Land requirements approximate 1 acre per 10,000 people per year. Many holes and low lands exist in the Basin that could be filled profitably using the sanitary landfill method. Countywide sanitary landfills are being operated economically and efficiently by mosquito control districts in Florida. One-man refuse collection and sanitary operation in towns of 1,200 or less have recently been proven feasible in Oklahoma.

5. Implementation of a program by Federal, State, and local interests to eradicate infestations of alligatorweed and water hyacinths in the Basin.

6. Employment in all counties of a full-time man working on rodent control, especially in the rural areas.

An unsolved financial problem is how the coastal counties in Georgia with small human populations could adequately finance mosquito abatement districts. The future solution to this problem would appear to be financial assistance by the State of Georgia. Such State aid to organized mosquito control agencies in Florida has proven very successful. State aid in Florida includes funds, supplies, services, and equipment.

In order that vector control programs will be compatible with multipurpose functions, it is essential that there be coordination between all interests concerned, such as agriculture, wildlife conservation, health, and water project developers.

POTENTIAL PROBLEMS AND SOLUTIONS

Based on present knowledge, the one vector problem that appears to be on the rise and could be a significant one in the Basin is mosquito-borne encephalitis -- both the Eastern and St. Louis strains. Eastern encephalitis has caused losses among horses in the Basin. Sooner or later it could cause epidemics among man, as was true in New Jersey in 1959 (this constituted New Jersey's first confirmed human cases, even though it had killed horses there for at least 50 years). The Eastern disease occurs principally in areas with vast fresh-water swamps and salt marshes such as those in the Coastal Plain.

St. Louis encephalitis, a human disease, is not known to have occurred in the Basin, but it has recently been reported from Florida. This disease presents a threat to communities in the Basin that allow uncontrolled production of Culex mosquitoes.

On the basis of current knowledge concerning mosquito-borne encephalitis, the only feasible approach to control of the disease is a program of prevention, i.e., mosquito control for the community (or population groups) and protection against mosquito bites for the individual.

COSTS AND BENEFITS

The estimated costs of needed vector control programs are included in Table PH1. Studies in the Chatham County, Georgia area have shown that the total cost of the program is being substantially balanced by reduced costs to families in the purchase of household sprays, aerosol bombs, and repellents.

The principal benefit of any well organized vector control program is to provide adequate safeguards to the public health. This includes freedom of disease and infirmity which is difficult to evaluate in dollars and cents. Recent research studies have shown, especially in small children, that permanent brain and motor damage frequently results in cases of mosquito-borne encephalitis. The prevention of just one case of permanent damage would amply justify the amount of money proposed for vector control work in any one of the towns or counties in this Basin.

Additional benefits of vector control programs would be an acceleration of development and use of water front land. It is common knowledge that excessive numbers of salt-marsh mosquitoes and other vectors on such land are an impediment to industrial plants, subdivision developments, and recreational areas. Wilmington Island, Chatham County, is now experiencing a great upsurge in construction as a result of the successful mosquito control efforts in Chatham County.

Another benefit would be to provide economic safeguards, particularly with reference to tourism or resort areas. This is exemplified by the 1959 outbreak of Eastern encephalitis in New Jersey. Although this outbreak involved only 33 human cases with 21 deaths during a 2-month period, it was estimated that the episode caused a loss to Atlantic City hotels of $2,000,000.

TABLE PH 1
VECTOR PROBLEMS AND PROGRAMS
OGEECHEE BASIN

Location and 1960 Population	Vector Problem Degree* 1	2	3	Approximate Annual Cost of Vector Control Program Present	Needed	Refuse Disposal Method	Storm Water Drainage Problems	Open Water With Sewage Problems	Comments
Claxton 2,672		M R	F T	None	7,000	Open dump	Moderate	Moderate	
Fort Stewart 4,500	M		F R T	50,000	50,000	Sanitary landfill	Severe	Light	
Hinesville 3,174		M	F R T	None	4,000	Open dump	Moderate	Light	Small roach control program.
Hunter AFB 5,560	M		F R T	15,000	15,000	Modified sanitary landfill	Light	Light	
Metter 2,362		M R	F T	None	6,000	Open dump	Light	Moderate	Mosquito problems in sewage plant outfall ditch.
Millen 3,633		M	F R T	2,000	10,000	Open dump	Light	Light	Flood-water mosquito problems from Ogeechee River Swamps.
Pembroke 1,450		M F	R T	None	4,000	Open dump	Moderate	Severe	
Savannah 149,245	M	F	T	See Chatham County		Sanitary landfill	Severe	Moderate	

(10/2/61)

TABLE PH 1 (CONT'D)
VECTOR PROBLEMS AND PROGRAMS
OGEECHEE BASIN

Location and 1960 Population	Vector Problem Degree* 1	2	3	Approximate Annual Cost of Vector Control Program: Present	Needed	Refuse Disposal Method	Storm Water Drainage Problems	Open Water With Sewage Problems	Comments
Statesboro 8,356		R	M F T	7,000	15,000	Sanitary landfill	Light	None	New sewage treatment plant eliminated severe mosquito problems.
Twin City 1,095		R	M F T	None	4,000	Open dump	Light	Moderate	No town sewage system.
Bryan County				None	30,000				
Bulloch County		R		Rodent control only 6,000	6,000				
Chatham County	M	F	R T	140,000	140,000		Severe	Severe	Great need for county drainage plan and enlarged program.
Emanuel County		R		Rodent control only 6,000	6,000				
Liberty County				None	45,000				
McIntosh County				None	35,000				
Totals				226,000	377,000				

*1 - Severe
2 - Moderate
3 - Light

M - Mosquitoes
F - Flies
R - Rats
T - Ticks

(10/2/61)

AIR POLLUTION

PROBLEMS

From information available, it is believed that the Ogeechee Basin is relatively free from air pollution sources. A problem of significance is created by the Kaolin mills in the Sandersville area adjacent to the Basin and just south of Warthen. This area produces about three-fourths of the nation's supply of kaolin. In the past, these mills have discharged kaolin dust at periodic intervals that created a nuisance for the City and nearby residents. The State Department of Health reports several complaints, in the past, concerning this air pollution.

Another problem area is in and around Savannah. The air pollution problems are caused by chemical fumes, dusts, smoke, and odors from pulp and paper mills, chemical plants, asphalt refineries, meat packing plants, rendering plants, and various other industries.

Three minor local sources of air pollution exist in Bullock County (Statesboro area). Contaminants present include dust, fumes, gases, and smoke. There is no real proof that any of the contaminants are present in sufficient concentrations to present a health hazard, but further studies are necessary since the types of substances present are potential hazards if present in sufficient amounts.

Natural air-borne pollen is a problem at certain times of the year.

STATUS OF EXISTING PROGRAMS

Public Law 159-84th Congress and its amendments provide for "Federal technical services and financial aid to State and local government air pollution control agencies and other public or private agencies and institutions in the formulation and execution of their air pollution abatement research programs." The Surgeon General may (1) encourage cooperative activities by State and local governments for the prevention and abatement of air pollution, (2) collect and disseminate information relating to air pollution and the prevention and abatement thereof, (3) conduct investigations and research and make surveys, and (4) prepare and publish reports and make appropriate recommendations with regard to the control of air pollution.

The Industrial Hygiene Service, Georgia Department of Public Health, has maintained records of complaints on industrial air pollution problems since 1945. Control measures used have consisted of investigation of these complaints, and, where justified, discussion with the offending parties to work out a solution satisfactory to all persons concerned.

(10/2/61)

Work is underway by the Public Health Service and the State Department of Public Health on a State-wide survey to locate all sources of air pollution in Georgia. The survey began January 1, 1961, and it will require 12 months to complete the study, analyze the data, and prepare a report. The Georgia State Department of Public Health cooperates with the Public Health Service in a national air sampling network with urban stations located in Atlanta, Augusta, Savannah, Columbus, and Macon.

EXISTING NEEDS

In the September 1959 report, "Industrial Air Pollution Problems in Georgia", a need was expressed for a comprehensive study of air pollution problems in Georgia. As pointed out above, this survey has started, and after it is completed, the type of legislation and programs needed will be determined. This will in turn determine the personnel and funds required to implement an air pollution control program in Georgia.

The September 1959 report indicated a need for some positive research on control of the industrial air pollution problems. This need is in the following order of importance: pulp and paper industry, rendering plants, industries disseminating oxides of nitrogen and sulfur, and the kaolin, talc, slate and Fullers earth industry.

POTENTIAL PROBLEMS AND SOLUTIONS

It is believed that industrial development and municipal growth in the Basin will introduce no major air pollution problems by the year 2000. The existing problems need additional investigation to determine changes in process, etc. to reduce pollutant releases to the air. Reduction of air-borne pollen problems can be accomplished by adequate weed control in affected areas.

Measurement and identification of industrial nuisances such as smoke, odors, and noise can be done scientifically. These results form a sound basis for industrial zoning, a tool which should be considered in development and planning within this Study Area.

COSTS AND BENEFITS

The costs of control of air pollution cannot be evaluated since specific quantity and quality information is not available for the sources.

Benefits to be derived from air pollution abatement result from reduction in nuisances, effects on public health, and decrease in maintenance costs of buildings and of personal property. Benefits are considered to be equal to costs of air pollution control.

(10/2/61)

RADIOLOGICAL HEALTH

PROBLEMS

The total radiological health problem is best determined by taking into account all of the following sources of radiation; natural, air, milk and food, water, and local sources such as work environment, medical treatment, fluoroscope machines, etc. The total extent of the effects of these sources is not known in the Ogeechee Basin and this limitation must be borne in mind in the interpretation of existing data.

There are no nuclear reactors or known uses of radioactive isotopes by industries, hospitals, or research projects in the Basin; therefore, no radiological health problems occur from local sources.

There are no radiological monitoring stations in the Basin, and the nearest air monitoring stations are in Atlanta, operated by the Georgia Department of Public Health, and in Waynesboro, operated by the Atomic Energy Commission's Savannah River Plant. Data from the Waynesboro station indicate that in 1960 the activity in the air in the Ogeechee Basin ranged between 0.02 and 0.50 micromicrocuries per cubic meter of air.

Sampling and testing of milk for radioactivity are accomplished at Atlanta, Georgia, and Charleston, South Carolina, the nearest points to the Ogeechee Basin. The data are therefore of little use in interpreting the problem in the Basin.

STATUS OF EXISTING PROGRAMS

There are no Federal, State, or local radiological health activities operating in the Basin. The State Health Department plans a surface water monitoring program to gather data on background counts in streams. This will require several sampling stations, at least one of which may be located on the Ogeechee River. The State Health Department wishes to assume the job of inspecting the facilities and operations of users of radioistopes which is now being done by the Atomic Energy Commission.

The U. S. Public Health Service is expanding its water quality basic data program, but present plans are to locate water sampling stations on other river basins in Georgia. Two existing basic data stations, which gather information on radioactivity in water as well as other quality data, are located on the Savannah River, one below the Atomic Energy Commission's Plant at Aiken, South Carolina, and the other northwest of Savannah. Limited data was gathered in a water quality study and is presented in the Water Quality Basic Data report for the Southeast River Basins.

(10/2/61)

EXISTING NEEDS

There are no present needs for control of local radiological health hazards in the Basin as there are no sources.

The State does need additional funds and personnel to enable it to expand the surface water and air monitoring programs in order to establish a State-wide radiation background picture for future use. Assistance could also be used in a surveillance program for radioactive contamination of milk and food supplies.

POTENTIAL PROBLEMS AND SOLUTIONS

Limited uses of radioisotopes might occur in the Basin in the future. Control of their use and the disposal of their wastes should be considered.

Solutions to the existing and potential State-wide problems would be the following:

1. Enact specific State Legislation to control radioactive pollutants and license radioisotope users.

2. Provide additional funds and personnel for the present State-wide program of radiation control, so as to expand the monitoring of air, water, milk and food supplies.

COSTS AND BENEFITS

No specific costs can be allocated to this Basin since no controls are operating in the Basin at the present time. Future State-wide costs could be allocated on a population basis and according to costs of control of sources of radiation in the Basin.

Benefits to be derived by control of radiation hazards result in safeguards to public health. Benefits are considered equal to costs.

SOLID WASTES

INTRODUCTION

Most communities collect and dispose of solid wastes as a governmental service, financing the operation by general taxation or by a special service charge. In a few instances, the collection and disposal is left to the individuals producing the waste or to private collectors who charge a fee for the service.

Methods of disposal vary, including dumping on the surface, placing in sanitary landfills, and incineration. The amount of waste produced on a national average is 0.8 to 1.0 cubic yard or about 650 pounds per person per year (approximately 2 pounds per person per day).

Incineration is considered as one of the best methods of disposal but none of the communities in the Basin are using this method. Incineration of waste is not economical for communities of the size found in the Basin since it requires a population of 50,000 or more to support this operation.

Sanitary landfills are the best method of waste disposal for any small community having suitable land available within reasonable hauling distance, and it can be used at a cost which is not prohibitive. It is an effective and proven method, accepted by the State Department of Public Health.

PROBLEMS

Open dumps are the most common method of solid wastes disposal used by small communities in the Ogeechee Basin, (See Table PH 1) but it is not an accepteable method because of the health problems and nuisances created. Costs for dump operations, ignoring benefits, is approximately 50 percent of that of sanitary landfill operation. Two canneries, four meat packing plants, and one poultry processing plant also produce solid wastes, and in two instances dispose of their wastes to dumps. The others dispose of their wastes with municipal refuse.

STATUS OF EXISTING PPOGRAMS

The State and local health departments have adequate authority to control the storage, collection, and disposal of solid wastes. Fort Stewart, Savannah, and Statesboro are using sanitary landfills for disposal of their refuse. Hunter Air Force Base has a modified sanitary landfill. Claxton and Twin City are now using open dumps but have plans underway for instaliation of landfills. All of the other communities in the Ogeechee Basin are using open dumps for the disposal of solid wastes.

(10/2/61)

EXISTING NEEDS

There is a need in the Basin for the installation of sanitary landfill waste disposal method for twenty-six communities. All communities should follow accepted sanitary practices for the storage, collection, and disposal of solid wastes. Some of the communities will need to revise or adopt sanitary regulations and ordinances to enable them to cope with the problem.

POTENTIAL PROBLEMS AND SOLUTIONS

Two communities in the Basin are now making plans for sanitary landfills and will probably have them in operation by 1962. There are twenty-four other communities needing acceptable solid wastes programs. At the present rate of progress of sanitation in the Basin, three of these will probably have sanitary landfills by 1975 and five or six more by 2000. It would be highly desirable to have this schedule accelerated in order for all communities to have proper refuse handling programs.

Using a land requirement of one acre per 10,000 persons per year, the following land will be necessary for refuse disposal for the period shown in Table PH 2. No land requirements for buffer zones have been calculated since a good operation can be carried on very close to residential sections and unsatisfactory building sites are often reclaimed for light building purposes.

TABLE PH 2
LAND REQUIREMENTS FOR REFUSE DISPOSAL
YEARS 1960 - 2000
OGEECHEE BASIN

Period of Time	Average Population to be Served	Acres Required
1960 - 1964	40,000	20
1965 - 1974	53,000	53
1975 - 2000	66,000	165
	Total	238

COSTS AND BENEFITS

Present costs for construction of incinerators ranges from $2000 to $4000 per ton daily capacity. Operational costs vary considerably with the City of Atlanta reporting $1.48 per ton for the year 1959, and $1.27 per ton for 1960. Other cities report

costs two to three times this amount.

Cost of operation of sanitary landfills averages $0.50 to $1.00 per ton of refuse handled. Cities as large as Los Angeles, California and New York City use this method of disposal. New York City's experience has shown that disposal by sanitary landfills costs approximately half that of incinerators.

Sanitary landfills require about one acre of land for proper disposal of the wastes from 10,000 people each year. Cost of operation of a solid refuse program, including collection and disposal, will vary with each community but will, depending on the size of the community, range from $1.00 to $4.50 per year per person. Based on a scaled cost, annual cost for a solid refuse program in the Ogeechee Basin (See Table PH 2) will be $129,000 in 1960, $150,000 by 1975 and $178,000 by 2000.

Studies have shown that improper solid waste handling breeds flies, which accounts for higher rates of diarrhea and dysentery, and for rodents which carry typhus and other less familiar diseases. Good sanitation practices, such as proper storage, collection, and disposal of wastes, help reduce these diseases. Improper disposal also breeds mosquitoes and creates odor nuisances. Open dumps often catch or are set on fire and become nuisances and air pollution problems. Benefits from adequate solid wastes handling operations is therefore considered to be equal to the cost of these operations.

SUMMARY AND CONCLUSIONS

SUMMARY

The Ogeechee Basin is mainly an agricultural area with environmental health problems typical of rural areas and small communities. The exception is that portion of Savannah which lies in the Ogeechee Basin.

Of the four health problems discussed in this memorandum, none are considered major treats to health. However, the control of mosquitoes, flies, and rodents is essential for the prevention of encephalitis, typhus, and Rocky Mountain spotted fever as well as for making the area available for development.

Important causes of vector problems due to man's activities include those associated with the disposal of sewage wastes, the storage and disposal of refuse, water-holding catch basins, uncontrolled flow from artesian wells, the disposal of dredge spoil, and the accumulation and disposal of manure on farms.

Present vector control programs consist of one mosquito control district (Chatham County), two military base programs (Fort Stewart and Hunter Air Force Base), several municipal mosquito control programs, and two countywide rodent control programs (Bulloch and Emanuel Counties).

Houseflies, salt-marsh mosquitoes, and rat fleas are also detrimental, and all are prevalent in the Basin.

Three communities in the Basin are using sanitary landfills for solid wastes disposal, one community uses a modified landfill, and all the other communities are using open dumps. However, two of these latter communities have plans underway for the use of sanitary landfills.

Air pollution in the Basin is confined to a kaolin dust problem in the vicinity of Sandersville; to chemical fume, dust, smoke, and odor problems at Savannah; to local sources in Statesboro; and to air-borne pollen.

There are no nuclear reactors, and no known uses of radioisotopes by industries, hospitals, or research projects in the Basin, and therefore, no radiological health problems affecting water or land resources.

(10/2/61)

CONCLUSIONS

Control measures and supportive services needed to reduce public health problems associated with insect and rodent vectors are:

1. State enabling legislation permitting the establishment of tax-supported vector control districts in any county of Georgia.

2. Regulations requiring the control of wasteful flow from artesian wells.

3. More extensive surveys of vector disease occurrence and vector problems.

4. Increased training of local health department personnel in vector control intelligence.

5. Expansion of entomologic and engineering consultative services to agencies, industries, and individuals concerned with water and land resource developments.

6. Development of better permanent control techniques in salt marshes that will serve multi-interests.

7. Establishment of mosquito control districts in Bryan, Liberty, and McIntosh Counties.

8. Development of better equipment and methods for constructing and maintaining water management ditches.

9. Development of master-planned countywide water management systems.

10. Improved design for future catch basins and modification of existing catch basins so that they do not hold water.

11. Increased use of sanitary landfills in towns and in counties.

12. Development of improved methods for the sanitary handling of manure and other wastes on livestock and poultry farms.

13. Establishment of countywide rodent control programs where none exists.

14. Greater consideration of mosquito prevention and control measures in connection with future spoil dredging activities and placement of spoil from future ditch construction.

(10/2/61)

15. Implementation of a program for the control and progressive eradication of alligatorweed and water hyacinths in the Basin.

16. Financial assistance (State aid) to counties with major vector problems but with small human populations, and consequently, little solid waste.

17. Better coordination between agencies so that vector control programs are compatible with multipurpose functions.

Except for the Savannah area, it is believed that industrial development and municipal growth in the Basin will introduce no major air pollution problems by the year 2000. The need for a survey of problems, initiation of research, and expansion of present programs is based primarily on State-wide needs rather than by specific problems in the Basin. The needs and solutions will be more adequately determined by an air pollution survey started January 1, 1961.

Adequate methods of refuse storage, collection, and disposal should be applied in all communities. Twenty-six communities should start programs no later than 1975. Two hundred thirty-eight acres of land will be needed to operate sanitary landfills for the period 1960 to 2000 in the Basin. This land can be utilized for light building construction, once it is filled.

There are no existing radiological health hazards in the Basin. Future development is not expected to create any significant radiological health problems by 2000. The State needs additional funds and personnel to enable it to expand the water, food, and air monitoring programs so as to establish a State-wide radiation background picture for future use.

APPENDICES AND BIBLIOGRAPHY

APPENDIX A
DEFINITIONS AND ABBREVIATIONS

1. cfs - cubic feet per second.
2. Garbage - putrescible animal and vegetable wastes resulting from the handling, preparation and consumption of foods.
3. gpcd - gallons per capita per day.
4. gpd - gallons per day.
5. mg - million gallons.
6. mgd - million gallons per day.
7. PE - population equivalent.
8. ppm - parts per million by weight.
9. Pollution, water - the addition of sewage, industrial wastes, or other harmful or objectionable material to water.
10. Quality, water - is defined as the expression of water characteristics in terms of its physical, chemical, bacteriological, biological, and radioactive content.
11. Resources, water - is defined as the water available to serve mankind and his civilization for the varied, complex, and often conflicting beneficial uses. These uses include sources for municipal and domestic supplies, agriculture, industrial development, and for recreation, propagation of aquatic life and other forms of wildlife, navigation and ultimate waste disposal.
12. Supplies, domestic water - are those supplies used for individual families, including those also serving tenant families living on the property. Domestic supplies do not include commercial establishments, schools, churches, or camps.
13. Supplies, industrial water - are considered as industrially owned supplies, primarily developed for process or cooling purposes but which might be incidentally used for sanitary purposes. This includes water used in the thermal generation of power.
14. Supplies, municipal water - as used in this memorandum are public supplies serving a municipality or communities of 50 or more people.
15. Supplies, semi-public water - are supplies for schools, motels, camps, and other supplies serving water to the public; or commercial establishments not classed as municipal or industrial.
16. Wastes, solid (or Refuse) - includes all wastes of a solid nature not otherwise disposed of to the sewers or to the atmosphere. This includes all putrescible and nonputrescible solid wastes such as garbage, rubbish, ashes, street cleanings, deal animals, abandoned automobiles, and solid market and industrial wastes.
17. Wastes stabilization ponds - a properly engineered and operated pond for the biological reduction of organic wastes.
18. Water supply systems - includes the works and auxiliaries for collection, treatment and distribution of the water from the source of supply to the free-flowing outlet of the ultimate consumer.

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